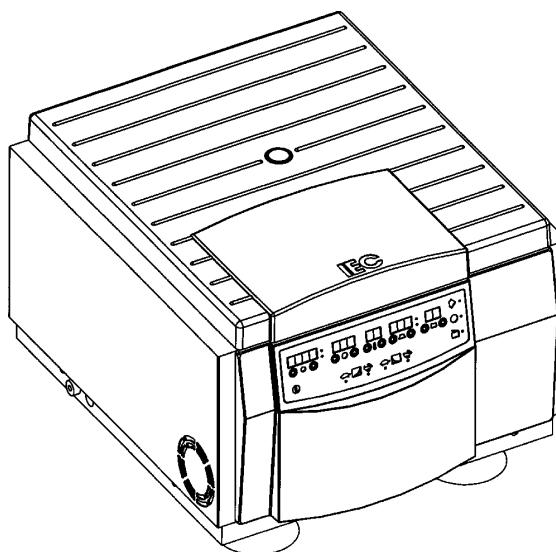


SERVICE MANUAL SM3750

Revision 1



Centra-CL3 Series

Centra-CL3 Ventilated Centrifuge

Cat. No. 3750 -- 120 VAC, 60 Hz

Cat. No. 3751 -- 220, 230, 240 VAC, 50/60 Hz

Centra-CL3R Refrigerated Centrifuge

Cat. No. 3755 -- 120 VAC, 60 Hz

Cat. No. 3756 -- 220, 230, 240 VAC, 50 Hz

Cat. No. 3757 -- 230 VAC, 60 Hz

Thermo IEC

300 Second Ave.

Needham Heights, MA 02494

Tel. +(781) 449-8060 Fax +(781) 444-6743

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1 Introduction

1.1 General Product Description

Centra-CL3 series units are high-speed, multipurpose centrifuges, used in medical, industrial, and scientific applications.

The CL3 Series is available in two versions: ventilated (Centra-CL3) and refrigerated (Centra-CL3R). Sections of this manual that apply to the refrigerated version will be designated Centra-CL3R or refrigerated only.

Both units accommodate a wide variety of rotors, including fixed angle, swinging bucket, and fixed horizontal designs. They can process tubes, bottles, microplates, microcapillary tubes, cytological slide carriers, and microsample tubes. The units can centrifuge up to one liter of fluid in a single operation.

Each centrifuge has an easy to use front panel that provides two modes of operation: **Manual** and **Programmed**.

Manual mode is used for entering temperature (CL3R only), speed/force, and time values for individual runs.

Program mode allows you to define and save a maximum of ninety-nine specific sets of run parameters, to recall and reuse.

The CL3 Series features a maintenance-free, brushless motor, and an easy-to-use front panel, which provides three versatile timing modes: automatic timed run, momentary spin, and continuous operation (hold mode). Acceleration and brake rates may be controlled, to optimize runs: rapid for fast separations or slow for delicate samples. Repeat runs, with the same speed and time settings, may be achieved at the touch of a key.

A fail-safe cover interlock insures that the cover is closed, before a run can begin, and keeps the cover closed, until the rotor has reached a safe low speed (below 100 rpm), even in the event of a power failure.

The rugged steel cabinet and rigid construction provide quiet operation and long term reliability.

1.2 About This Manual

The Operations Manual contains all of the information needed to install, operate, and maintain a CL3 Series centrifuge. Refrigerated and ventilated models operate similarly, and any differences are highlighted and noted, throughout this manual. This manual, also, contains speed and force, derating, chemical resistance, and decontamination tables. The last chapter lists the units' specifications.

This manual is written for centrifuge operators. In addition to operation information, it contains a few basic troubleshooting techniques, and a chapter on maintenance. This **Operation Manual** is not a guide for servicing centrifuge units.

1.3 Warnings, Cautions, and Notes

The terms **warning**, **caution**, and **note** have specific meanings in this manual.

- A **Warning** advises against certain actions or situations that could result in personal injury.
- A **Caution** advises against actions or situations that could damage equipment, produce inaccurate data, or invalidate a procedure.
- A **Note** provides useful information regarding an operation, function, or procedure.

2 Installation

2.1 Receiving the Unit

International Equipment Company (IEC) ships the centrifuge in a carton that protects it from shipping hazards. Follow the unpacking instructions on the carton. Be sure to complete and return the postage-paid warranty card.

2.2 Site Preparation

The unit normally resides on a bench top. The Centra-CL3 (ventilated model) can be placed in a cold room (no colder than 0°C), for processing temperature-sensitive samples. When you remove the centrifuge from a cold environment, do not operate for a minimum of two hours, so that any condensation will evaporate.

Note: When used in a cold room environment, some bearing noise may become evident. The bearing lubricant thickens at low temperatures. As the centrifuge speeds up, it is thinned and distributed more evenly. Once this occurs, any noise should subside.

The following table lists the physical dimensions for the Centra-CL3 and Centra-CL3R:

	CL3R	CL3
Sample Loading Height	12.5" (32 cm)	12.5" (32 cm)
Cover Closed Height	14.5" (37 cm)	14.5" (37 cm)
Cover Open Height	33" (84 cm)	33" (84 cm)
Width	26.5" (68 cm)	19.25" (49 cm)
Depth	21" (53 cm)	21" (53 cm)

A clearance of 8 cm (3 inches) should be provided on each side of the unit, to ensure proper ventilation. Place the centrifuge on a clean, dry surface, to make certain that the suction feet at the bottom grip the surface firmly. Keep the area beneath the unit free of debris and loose materials.

The resting surface must be level, to ensure quiet, vibration-free operation. A rigid and stable location is important. An improperly loaded centrifuge may vibrate or move.

Warning: International Electrotechnical Commission standard 1010 part 2-20 limits the permitted movement of a laboratory centrifuge to 300 mm (12 in) in the unlikely event of a disruption. Laboratory management procedures should require that no person or any hazardous materials enter within this boundary while the centrifuge operates.

2.3 Power Configuration

The CL3 Series uses AC power in different configurations, appropriate for use throughout the world. Please check the catalog number of the model that you have purchased, to ensure that the machine you have is the proper power configuration. For best results, the refrigerated centrifuge, Centra-CL3R, should be used on a dedicated line.

Variations in line voltage or frequency affect the unit's speed and other characteristics. Less than nominal line voltage may prevent the centrifuge from reaching maximum published specifications of speed and/or temperature.

Power line voltage, at some locations, may sag, when the refrigeration system turns on.

Power Cord

The unit requires a grounded power supply (3 prong outlet). If your facility does not have grounded power outlets, arrange for a proper grounding. The power cord plugs in on the left rear side of the unit.

Warning: Do not remove the grounding pin from the centrifuge power cord. Do not use the bare wired power cord to attach a power plug that does not have a grounding pin.

The power cord provided with the unit is correctly rated for the highest current demand. This power cord should not be interchanged with cords from equipment with lower current demand. Exchange of power cords between equipment may create a fire hazard.

Circuit Breaker

The system provides an automatic circuit breaker, for emergency situations, such as power surges, that could damage the unit.

If the circuit breaker trips:

1. Unplug the unit.
2. Press the white button, on the left side of the unit.
3. Plug the unit back in.

2.4 Moving the Unit

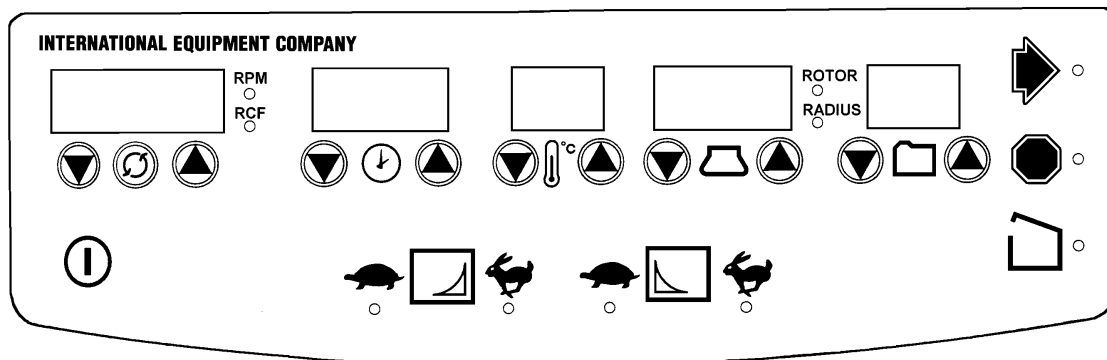
Suction cups, at the bottom of the unit, keep it anchored to the work surface. Keeping the unit stationary is a safety feature.

To move the unit to a new location:

1. Check that the new site meets the criteria in Section 2.2., before moving the unit.
2. Position a flat object, such as a tongue depressor, near a suction cup at the bottom of the unit.
3. Lift up an edge of the cup, and insert the flat object far enough to break the vacuum seal.
4. When all four cups are disengaged, lift the unit from the work surface.

Caution: When the unit is in its new location, ensure that the suction cups adhere correctly to the work surface.

2.5 The Front Panel



The Front Control Panel
(Centra-CL3R)



On/Off key: The **On/Off** key must be activated, to enable use of the front panel. This key applies power to the control panel and refrigeration system (Refrigerated model only). The **On/Off** key is inoperative during actual runs. Stop a run with the **STOP** key. Refrigerated models display chamber temperature whenever they are plugged in, but will not cool down if the unit is off. The red **STOP** light indicates that the centrifuge is plugged in.

The control panel contains numeric displays for RPM/RCF (Speed/Force), Time, and Temperature (Refrigerated only). These displays have two states or modes: Actual (bright display) and Set (dim display).

In Actual mode (bright display), they indicate current run conditions, such as:

- rotor speed or force
- elapsed time of, or time remaining in, the run
- actual temperature (Refrigerated only).

In Set mode (dim display), the display indicates the desired settings for the run. Set mode is operative:

- whenever you use the up and down arrows
- briefly, at the start of a run
- briefly, after the unit is switched **ON**

The display is bright, when it shows Actual run conditions. The display is dim, when it shows Set parameters. The numeric displays can, also, display warning or error messages (see Section 3.5). Descriptions of the displays appear on the following pages.



Speed/Force display: The number in the speed/force display (above this symbol) represents the rotor speed in RPM or force in RCF. Press this symbol to toggle between RPM and RCF. When RPM is selected, the display indicates revolutions per minute. When RCF is selected, the display indicates relative centrifugal force. Use the arrow keys to change the set speed or force. The display shows speed within 50 RPM. It never requires calibration. Select speed in increments of 100 RPM, from 1,000 through 8,500 RPM. Select RCF in increments from 1 - 1,000 xg by 50 xg and above 1,000 xg by 100 xg. The numeric display can, also, display warning or error messages (see Section 3.5).



Time display: The number in the display (above this symbol) indicates time. Below ten minutes, time is displayed as minutes:seconds. Above ten minutes, just minutes are displayed.

Time is set in:

- 1 second increments, from 1 - 59 seconds.
- 15 second increments, from 1 - 5 minutes.
- 1 minute increments, from 5 - 99 minutes.

In normal timed mode, the system counts down from the set point. In time **Hold** or momentary spin modes, the system counts up.

In At-Start mode, the timer begins counting at the start of a run. In At-Speed mode, the timer begins counting when the rotor reaches 95% of the set speed.



Temperature display: The number in the display (above this symbol) represents temperature in degrees Celsius, from – 9 °C through + 40 °C (Refrigerated only).



Program key: This key saves the currently displayed desired settings as stored programs 1 through 99 (see Section 3.3). The numeric display (above this symbol) shows the stored program number and mode of operation (see Section 3.2).



Rotor/Radius Key: The display (above this symbol) indicates the selected rotor number or the rotor radius, in centimeters. The rotor/radius key toggles between the two displays. The applicable IEC rotor numbers are supplied in the memory, along with their maximum radii, in centimeters. To select a rotor number, toggle to ROTOR, and press an arrow key under the rotor/radius display. To change the radius, toggle to RADIUS, and press an arrow key under the rotor/radius display. Note that the radius cannot be changed to a radius larger than the maximum radius, or less than the minimum radius, for the selected rotor.



Use the arrow keys to view or change the Set parameters for Speed/Force, Time, Temperature (Refrigerated only) Rotor/Radius, or Program. The first time the key is pressed, the numeric display switches from Actual readings to Set parameters, without changing them. If you press the key a second time, the selected parameter increases or decreases once for each depression. If you hold the key down, the setting will keep changing, until you release the key.

The longer you hold the key, the more rapidly the setting changes. Hold a key down, to approach a desired setting. Then, press the up or down key, repeatedly, to select the exact setting. When you release the arrow keys for 3 seconds, the display returns to the Actual readings.

Acceleration and Braking

Gentle acceleration and braking can be selected, when centrifuging delicate samples. The gentle settings avoid mixing of density gradients or breakup of pellets.



This key controls rotor acceleration up to 400 RPM. If the yellow light over the rabbit is lit, full acceleration is selected. If the yellow light over the turtle is lit, slow acceleration is selected. Slow acceleration takes from 15 to 35 seconds to achieve 400 RPM, depending on the rotor and its contents. After 400 RPM, full acceleration is applied, until the set speed is reached.



This key controls rotor braking. If the yellow light over the rabbit is lit, full braking is selected. If the yellow light over the turtle is lit, slow braking is selected. (This means the rotor will coast down from 600 RPM.) If both lights are out, all braking is disabled; and the rotor will coast from operating speed to a stop.



This key starts a run. A run is governed by the Set parameters (manual or programmed). The associated green light blinks, until the rotor reaches 95% of the set run speed. The light stays on until the end of the run.



This key stops a run. (A run will, also, stop automatically when the set time has elapsed or the start key is released, in momentary mode.) The red light will flash, to indicate the rotor is still slowing down (braking or coasting). When the run ends, the red light stays on, indicating that the rotor has stopped.



This key unlocks the cover. This key is inoperative if a run is in progress. Pressing it will not stop the run. The cover will not unlock, until the rotor has slowed to below 100 rpm. The cover will open automatically, on ventilated units only, at the end of a run.

3 Operation

3.1 Rotor and Accessories

A balanced load is essential for all centrifuges. An unbalanced load produces vibration, and can damage the unit. A 2 gram load imbalance, at a speed of 4600 RPM, imparts force equivalent to 9.1 kg (20 pounds) at rest. Always ensure that the rotor is loaded symmetrically, with a full complement of accessories, and a full (or paired) set of tubes. Tube adapters should also be installed symmetrically.

IEC rotors are dynamically balanced at the factory. IEC matches removable parts (trunnion rings, shields, buckets, and carriers) to within 1 gram, and stamps the weight on each piece. Check these markings, whenever you interchange parts, to ensure that opposite parts are matched. Ensure that the total weight of samples and removable parts, loaded in opposing positions, are equal in weight, to within 1 gram. The position numbers, present on many rotors and adapters, identify opposing tube positions.

To obtain good dynamic balance, opposite loads must not only be equal in mass, but must, also, have the same centers of gravity. Opposing containers must be alike in shape, thickness, and distribution of glass or plastic. This is especially important for large containers.

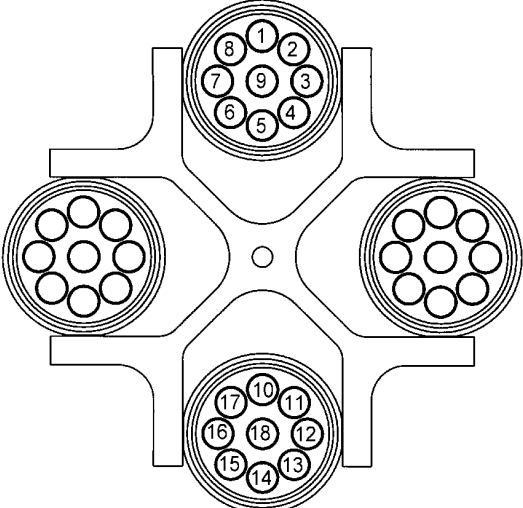
Tubes loaded into swinging bucket rotors must be symmetric, around the axis of rotation. Verify this by rotating the entire rotor 180°, by hand. The loads should be in the same apparent positions (not mirror images). In addition, the loads within each bucket must, also, be symmetric around the bucket's pivot axis. Verify this by ensuring that each bucket is loaded so that it does not tilt from the vertical, when the rotor is at rest. Maintaining balance within each bucket ensures that the bucket and the tubes swing out to horizontal, when the rotor reaches operating speed, applying centrifugal force toward the bottom of the tubes. Failure to achieve full swing-out causes vibration and premature wear of the rotor and the motor.

Samples of like (similar) specific gravities may be processed in the same run, provided that the samples of the same type are balanced around the rotor, as though they were the only pairs in the rotor.

Caution: Do **not** exceed maximum rated speed for each rotor/accessory combination. Maximum rated speeds can be found in Section 4.2 - **Speed And Force Tables**.

Rotor Balance

Load tubes in the following manner:

1. Load two tubes at positions: 9 and 18. 2. Load four tubes at positions: 1, 5 and 10, 14 or 7, 3 and 16, 12 3. Load six tubes at positions: 1, 9, 5 and 14, 18, 10 or 7, 9, 3 and 12, 18, 16 4. Loading an odd number of tubes is not recommended.	
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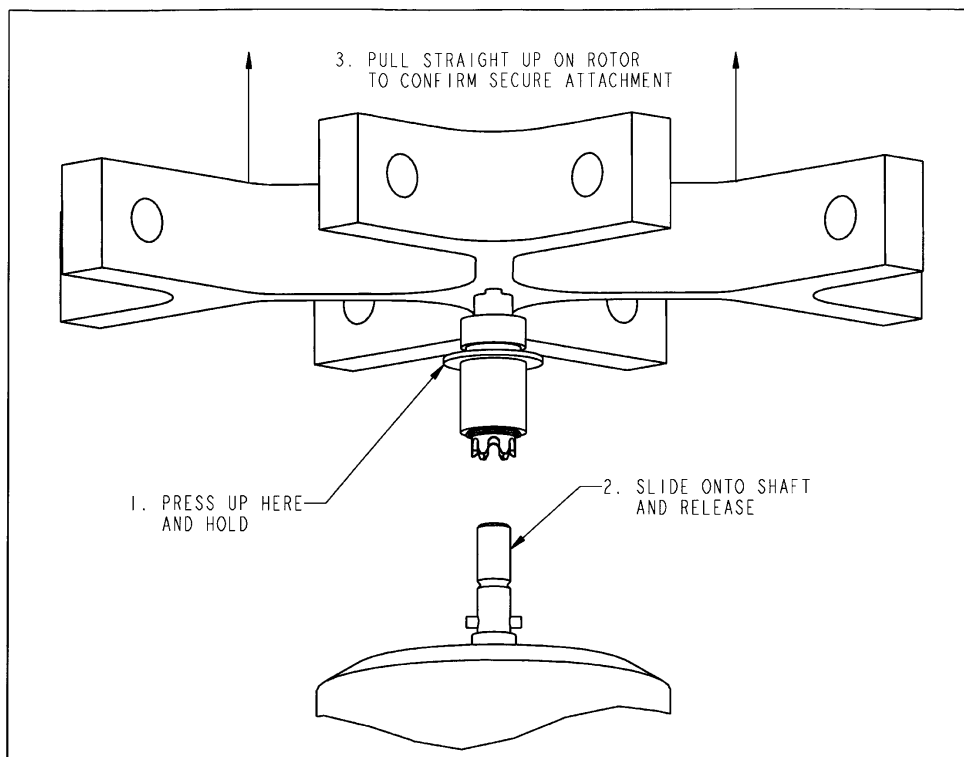
Vibration

All centrifuges have critical speeds, at which vibration occurs. As the speed increases, beyond the critical speed, vibration will cease. This inherent condition, also, occurs during deceleration. An imbalanced load intensifies these critical vibrations. **Do not continuously operate this centrifuge at observed critical speeds.**

Rotor Installation

To install the #243 rotor:

1. Press the disk (located on the underside of the rotor) to the rotor.
2. Slide the rotor over the shaft, until it snaps into place. Release the disk.
3. **Pull the rotor straight up, to insure a positive lock.**



Rotor Removal

To remove the 243 rotor:

1. Press the disk (located on the underside of the rotor) to the rotor.
2. Lift the rotor straight up.
3. Release the disk.

Rotor Adapter

To install the shaft adapter for an existing rotor:

1. Press the adapter disk, and slide the adapter over the rotor shaft. Release the disk.
2. Pull the adapter straight up, to insure a positive lock.
3. Align the rotor keyway with the key on the shaft adapter, and place the rotor onto the adapter.
4. Tighten the rotor locking nut (with the provided wrench), until it tightly engages the rotor.

To remove existing rotors from the shaft adapter:

1. Remove any sample tubes, shields, buckets, and other accessories, from the rotor.
2. Unscrew and remove the locking screw.
3. Grasp the rotor, and rock it front-to-back, and side-to-side.
4. Remove the rotor from the shaft.

3.2 Starting and Stopping a Run

Read Section 2.5, for a general description of the front panel. The settings displayed on the front panel always govern the operation of the unit. The number or symbol, above the Program icon, shows the unit's operating mode. It is important that the unit be in the correct mode for the desired operation.

These digits and symbols are displayed above the program icon. They can be any of the following:

- blank The unit is in **manual operation**.
- 1-99 The unit is under control of the displayed **stored program** number.
- C The unit is set to **Rapid Condition**, a special program discussed in Section 3.4.

The display indicates the last parameters selected for each Program mode operation.

Manual Operation

For manual operation, set the mode so that the display above the Program icon is blank. Select the desired temperature (CL3R only), speed/g-force, run time, acceleration mode, and braking mode. Press **START**, to start the spin.

The minutes display counts down, and displays the time remaining in the current spin, during manual operation.

The specified run time begins when the **START** key is pressed, or when the rotor reaches 95% of set speed (see Timing Mode). Braking begins when the elapsed time reaches this desired setting. Run time does **not** include braking time.

The spin will stop automatically, at the end of the desired interval. A run can, also, be stopped, at any time, by pressing the **STOP** key.

The settings can be changed during a manual run. These changes affect the run in progress. If the time setting is changed, during a run, the unit adjusts the count-down timer, to display the revised setting as the total time of the run. If the new time selected is less than the elapsed time, the run will end.

The unit's mode (settings) cannot be changed during a program mode spin.

Timing Mode

Four timing modes are available on these units: To select a timing mode, press the down arrow, under the time display, until the time goes below zero, and the appropriate symbol is displayed.

Momentary Mode (---) - Momentary spin is useful for easily separated samples, for simultaneous mixing of samples, and to deposit condensate droplets at the bottom of the tube.

For momentary spin, set the mode so that three dashes (---) appear above the Clock icon. Select temperature (CL3R only), speed/g-force, acceleration mode, and braking mode, as for manual operation.

Press and hold the **START** key. The run starts when you press the key, and ends when you release the key. In this mode, you can perform very quick separations or protocols.

During a momentary spin, the unit displays actual values, not desired settings. The time display counts upward, and displays the elapsed time since the **START** key was pressed.

Hold Mode (HLd) - For hold mode (operation without preset time limit), set the mode so that **HLd** appears in the Time display.

Select temperature (CL3R only), speed/g-force, acceleration mode, and braking mode, as with manual operation. Press and release the **START** key. The run starts when you press the key, and stops only when you press the **STOP** key. Hold mode is like manual operation, except that the time setting is not used. During a run in hold mode, the time display counts upward, and displays the elapsed time of the spin.

At-Start Mode (ACC) - The set time will start counting down at the beginning of acceleration (when the start key is pressed). The unit is originally set to this mode.

At-Speed Mode (SPd) - The set time will start counting down, when the rotor has reached 95% of set speed. The display will alternately show the set time and SPd, during acceleration to 95% of the set speed.

To select a timing mode, press the Time down arrow key, and scroll below 0 minutes. **ACC**, **SPd**, **HLd**, or --- will appear. Press and release the Time down arrow key, to choose the desired mode. After three seconds, or after pressing the **PROGRAM** or **START** keys, the display will return to the last selected run time, provided the up arrow key has not been pressed.

The timing mode is stored along with the other parameters, when a program is saved. If a saved program has been recalled, altered, and not re-saved, the timing mode will revert back to the previous mode, when recalled.

3.3 Stored Programs

The CL3 Series has an internal memory capable of holding 99 sets of run parameters. Each set, or program, is stored and can be recalled by selecting a program number (from 1-99). Programs are retained in memory, even if the power is turned off. When necessary, a program can be modified for a particular run or changed permanently. You **cannot** change the unit's program, rotor/radius, or timing modes, during a spin.

Lock Program

Programs can be locked by scrolling to the desired program, and pressing the **PROGRAM** key three times. When you scroll to a locked program, the letter **L** will flash in the program display, after the program number is displayed. To unlock a program, scroll to the desired locked program and press the **PROGRAM** key three times. Parameters of locked programs cannot be changed.

Recall Program

Press a program arrow key, to select the appropriate program number.

The program's set parameters will be displayed. Press **START**, to begin this run.

Add/Change Program

Select a program number with the program arrow keys. The current program parameters will appear on the display. Modify the desired parameters, using the parameter arrow keys, or the ACCEL or BRAKE keys. The program number will flash, indicating that the program was changed, and has not, yet, been saved. Make the changes permanent by pressing the Program Save (file folder) key. The program number will stop flashing, and the new program settings will be displayed. The program will remain in memory, until further changes are made.

To make changes temporary, press **START**, without pressing the PROGRAM SAVE (file folder) key. The program display will flash, to indicate that the values are now stored in the manual program, and that the instrument is not currently operating from program mode. The original program will remain unchanged, as long as the PROGRAM SAVE (file folder) key is not pressed.

3.4 Centra-CL3R Refrigeration

Refrigerated units refrigerate the rotor chamber whenever the cover is closed and the unit is switched on.

Refrigeration is applied, as necessary, to cool the rotor chamber to the currently displayed temperature setting. If you use the keyboard, and momentarily display a cold temperature (stepping through stored programs, for example), refrigeration will not be activated.

If a temperature, higher than ambient, is specified, the unit will warm the rotor chamber by wind friction of the rotors and accessories, while spinning (see Rapid Condition).

If the rotor chamber is not at the specified temperature, it will not abort the spin. However, if the rotor chamber differs, at the start of a run, by more than 5°C, from the specified temperature. The °C display will switch between the actual and set/programmed temperatures, until the two temperatures come within 5°C. Press the **STOP** key, if the run should not continue at the actual temperature.

The unit is not designed for use as a refrigerator. The natural fanning action of the rotating horizontal and fixed angle rotors serves to maintain a uniform temperature distribution, inside the chamber. At zero RPM, there is no correlation between set and actual chamber temperatures.

Any frost or condensation, that forms in the rotor chamber, should be removed. Allow it to melt, and remove it with a sponge or cloth. When the centrifuge is not in use, turn it off, or leave the cover open (to disable refrigeration).

Rapid Condition

When the chamber temperature (CL3R only) is above the set temperature, Rapid Condition will run a rotor at 500 rpm, to increase air circulation in the chamber, to quickly cool the chamber to the set point. When the chamber temperature is below the set temperature, Rapid Condition will run the rotor at 2800 rpm, to warm the chamber to the set temperature. When the temperature has been reached, three beeps will sound, and the rotor will brake to rest. Some smaller rotors may not be able to warm the chamber to higher temperature settings.

To select this program, press the Program arrow keys, until a **C** appears in the Program display. Select the desired temperature, install a rotor, and press the **START** key.

3.5 Diagnostic Messages and Error Codes

The beeper sounds in these situations:

- Two times on power up.
- Three times at the end of a spin.
- Five times when a warning occurs

Diagnostics

Diagnostic messages appear in place of the speed display, in the following cases:

Message	Description
bAL	bAL indicates an unbalanced rotor. Open the cover, to erase this message. Verify that a balanced load is installed. Inspect the rotor, and rearrange the tubes, or add additional tubes, with fluid, to balance the rotor.
LId	LId appears if you press the START key, when the cover is not closed. Close the cover, to erase this message.
PFAIL	PFAIL appears if power was interrupted during a run. Press START , to resume the previous run. Press STOP , to erase this message. PFAIL indicates a power failure. This message appears when the unit is turned back on, following the failure. The front panel will alternate between the PFAIL message and the remaining run time, or elapsed time, if in Hold mode.

Error Codes

Error Codes require factory-authorized maintenance. A typical error means that the internal microprocessor has detected impermissible readings, or a failure, elsewhere, in the unit. Error messages appear in the speed display. When an error code is displayed, unplug and reconnect the unit to power. If the error code reappears, tell the service personnel which message appeared, when you report the problem.

Error Message	Description
Err 1	No Tachometer Tachometer signals were not present during the run. The rotor coasts to a stop. Cover opening is inhibited, after this error.
OSPd	Overspeed Speed is 200 RPM above the maximum speed for the installed rotor. The rotor will brake to a stop.
rEFR	Refrigeration Failure (Refrigerated only) The unit displays this code, if the measured temperature exceeds 45°C, at any time during the run.
FSAFE	Fail-safe Time out Independent circuitry, on the circuit board, has sensed a lack of activity, from the control microprocessor. All power circuits (including motor, latch, solenoid, etc.) are disabled.
COPF	Cop Watchdog/OpCode Trap Error The microprocessor has sensed a lack of activity, from the program that controls the centrifuge. The rotor will coast to a stop.
COP	COP Watchdog Not Enabled The microprocessor COP is not enabled. The rotor will coast to a stop.
UndFI	Undefined Interrupt The microprocessor was interrupted by an undefined source. The rotor will coast to a stop.
ILLOP	Op-Code Trap Error The rotor will coast to a stop
dIR	Wrong Direction of Rotation The microprocessor discovered wrong direction of rotation, during acceleration
Warnings during a spin: HEAd, LIId, PFaIL, and dIR error messages can occur during a spin. In this case, the rotor brakes or coasts to a stop, and the run ends.	

4 Applications

4.1 Introduction

This section describes the use of specific rotors and accessories. More detailed information is shipped with the rotor or accessory itself. This section contains five reference sections:

- Speed and Force Tables
 - Derating Table for Dense Samples
 - Chemical Resistance Table
 - Decontamination Table
 - Nomograph
-

Caution: Do **not** exceed maximum rated speed for each rotor/accessory combination. Maximum rated speeds can be found in Section 4.2 - **Speed And Force Tables**.

Relative Centrifugal Force (RCF or G-force) at a given speed varies with the rotor, and with the distance away (rotating radius) from the shaft of the centrifuge (center of rotation). The rotating radius is measured to the furthest **inside** tip of the tube, away from the centrifuge shaft. The Speed and Force Tables indicate the maximum speed and RCF that the Centra-CL3/CL3R can achieve, with various rotor/accessory combinations. The Derating Table specifies reductions in maximum RPM, when spinning samples with specific gravity above 1.2.

Use of any tube above its rated RCF can cause tube cracking. To avoid this, compare the G forces, specified in the Speed and Force Tables, with the ratings for the tubes that you are using. If the tubes are not rated for the force that the centrifuge will apply, look up their reduced G force, and enter it on the control panel.

Corrosive Solvents

Your IEC centrifuge is made of materials designed to resist immediate attack from most laboratory chemicals.

Prolonged exposure should be avoided, by immediately removing the chemical from rotor or assembly. Rotors and accessories placed in the chamber are made of a variety of materials, including aluminum and polypropylene. The Chemical Resistance Table shows the suitability of each material with different classes of reagents.

Section 5.2 describes how to clean and remove corrosion from the chamber, rotors, and accessories. Follow these instructions, and clean spills promptly, to minimize the effect of corrosive chemicals and to avoid expensive repairs.

4.2 Speed and Force Tables

4 Place Rotor 243 for Use only with Centra-CL3 and Centra-CL3R					
Carrier	Number of Places	Volume	Maximum RPM	Maximum RCF xg	Radius (cm)
6560E	2	50 ml Falcon/Corning	4000	3200	18
6561E	5	15 ml Falcon/Corning	4000	3200	18
6562E	9	Long (100-125mm) Blood Tubes	4000	3200	18
6563E	9	Short (75-100mm) Blood Tubes	4000	3200	18

Rotor Packages 52151, 52152, 52153, 52154

Rotor 215 4 Place Horizontal Swinging Bucket (Use requires 50968 tapered shaft adapter)						
No. of Places	Tube Volume (ml)	Trunnion/ Shield or Carrier	Max Speed (rpm)	Max RCF (xg)	Max Radius (cm)	O.D. x Length (mm) Common Tube Size
4	50	325/320**	4100	2650	14.0	30 x 116
4	50	350/323**	3800	2050	15.2	Falcon/Corning Conical
4	10	310/356	4300	2750	13.2	17.2 x 113
8	50	326/320	3600	2050	14.2	30 x 116
12	10	355/356	3600	1900	13.2	17.2 x 112
12	10	366/1013	4100	2400	12.8	16.5 x 107 16 x 75; 16 x 100
16	5 - 7	366/1018	4150	2450	12.8	14.2 x 103 13 x 75; 13 x 100
20	3 - 5	366/369	4600	2625	11.1	12.6 x 83 10-12 x 75
4	3	1024	2050	500	10.6	1" x 3" Microscope Slide

**** Order adapter 1106 and 571 cushion, to spin 15 ml Falcon/Corning Conical Tubes**

Rotor Package 52212

Rotor 221 6 Place Horizontal Swinging Bucket (Use requires 50968 tapered shaft adapter)						
No. of Places	Tube Volume (ml)	Shield	Max Speed (rpm)	Max RCF (xg)	Max Radius (cm)	O.D. x Length (mm)
6	10	356	4400	2800	13.0	17.2 x 102
6	15	303	4000	2600	14.6	17.2 x 119 Falcon Corning Conical Kimble 45168-125

Rotor 244 2-Place (Tray) Horizontal Microplate (Use requires 50968 tapered shaft adapter)						
No. of Places	Tube Volume (ml)	Carrier	Max Speed (rpm)	Max RCF (xg)	Max Radius (cm)	Width x Length (mm)
4	-	included #	4000*	1800	10.0	86 x 128 (96 well) Microplates
2	-	49852	4000*	1800	10.0	86 x 128 x 55mm Deep Plates

* Replacement carrier is IEC No. 49852

** See derating table for 244 rotor

Rotor Package 58012

Rotor 801 6-Place Fixed Angle 45° (Use requires 50968 tapered shaft adapter)						
No. of Places	Tube Volume (ml)	Shield	Max Speed (rpm)	Max RCF (xg)	Max Radius (cm)	O.D. x Length (mm)
6	50	305	4600	2950	12.1	30 x 133 Falcon Corning Conical*
6	50	320	5200	3300	10.8	30 x 116 Corning 8300-50

*With IEC 315 Conical Cushion

Rotor 804S 4-Place Fixed Angle 45° with 323 Sealed Dome Shields
(Use requires 50968 tapered shaft adapter)

No. of Places	Tube Volume (ml)	Shield	Max Speed (rpm)	Max RCF (xg)	Max Radius (cm)	O.D. x Length (mm)
4	50	323*	7200	6675	11.5	Falcon/Corning Conical
4	60	341	2500	1000	14.3	Corning

* Order adapter 1106 and 571 cushion, to spin 15 ml Falcon/Corning tubes

Rotor Package 58092

Rotor 809 12-Place Fixed Angle 45°
(Use requires 50968 tapered shaft adapter)

No. of Places	Tube Volume (ml)	Shield	Max Speed (rpm)	Max RCF (xg)	Max Radius (cm)	O.D. x Length (mm)
12	10	356	5300	3200	10.2	17.2 x 88
12	15	303	4800	2880	11.2	17.2 x 102
12	15	302	4200	2480	12.6	17.2 x 122 Falcon/Corning Conical

Rotor Package 58153

Rotor 815 24 Place Fixed Angle 33°
(Use requires 50968 tapered shaft adapter)

No. of Places	Tube Volume (ml)	Shield	Max Speed (rpm)	Max RCF (xg)	Max Radius (cm)	O.D. x Length (mm)
24	10	356	4800	2860/2340	11.1/9.1	17.2 x 88
24	15	303	4200	2360/1970	12/10	17.2 x 102
24	15	302	3800	2100/1800	13/11	17.2 x 122 Falcon Corning Conical

Rotor Package 58162

Rotor 816 8-Place Fixed Angle 33°

(Use requires 50968 tapered shaft adapter)

No. of Places	Tube Volume (ml)	Shield	Max Speed (rpm)	Max RCF (xg)	Max Radius (cm)	O.D. x Length (mm)
8	50	320	4600	2800	11.7	30 x 115 Corning 8300-50
8	50	305	4300	2650	12.8	30 x 134 Falcon/Corning Conical*

* With IEC 315 cushion, order adapter 1106 and cushion 571 to spin Falcon/Corning tubes

Rotor 818 12-Place Fixed Angle 35°

(Use requires 50968 tapered shaft adapter)

No. of Places	Tube Volume (ml)	Adapter Number	Max Speed (rpm)	Max RCF (xg)	Max Radius (cm)	O.D. x Length (mm)
12	5	-	8500	6060	7.5	12 x 80 IEC 2804, 2840
12	1.5 - 2	5762	8500	4680	5.5	11 x 66
12	B-D/.5	5761	8500	4770/3960	5.9/5.0	8 x 66
12	.4/.25	5760	8500	4680/3630	5.9/5.0	6 x 66

Rotor 819 10-Place Fixed Angle 35°

(Use requires 50968 tapered shaft adapter)

No. of Places	Tube Volume (ml)	Adapter Number	Max Speed (rpm)	Max RCF (xg)	Max Radius (cm)	O.D. x Length (mm)
10	10	-	8500	6060	7.6	16.1 x 85 IEC 2046, 2067, 2801, 2850

Rotor 836 6-Place Fixed Angle 30°

(Use requires 50968 tapered shaft adapter)

No. of Places	Tube Volume (ml)	Adapter Number	Max Speed (rpm)	Max RCF (xg)	Max Radius (cm)	O.D. x Length (mm)
6	30	-	8500	6060	7.5	25.8 x 100 IEC 2047, 2055, 2802
6	15	5965	8500	5820	7.2	16.1 x 109
6	5	5966	8500	5650	7.0	12.1 x 112
6	3	5967	8500	5490	6.8	10.9 x 95

Rotor 841 12-Place Fixed Angle 45°

(Use requires 50968 tapered shaft adapter)

No. of Places	Tube Volume (ml)	Adapter Number	Max Speed (rpm)	Max RCF (xg)	Max Radius (cm)	O.D. x Length (mm)
12	1.5 - 2	-	8500	4680	5.8	11 x 39
12	B-D	5763	8500	4770	5.9	B-D Microtainer Tubes
12	.5	5763	8500	3960	4.9	8 x 66
12	.4	5764	8500	4680	5.8	6 x 46
12	.25	5764	8500	3630	4.5	6 x 46

Microtube Rotors

(Use requires 50036 hub adapter on 50968 tapered shaft adapter)

Rotor Cat. No.	No. of Tubes and Tube Size	Adapter Cat. No	Max Speed (RPM)	Max RCF (xg)	Radius (cm)
891 ¹ (Aerosol Contained)	24 x 1.5 ml	-	8500	6740	8.35
	24 x 0.6 ml B/D Microtainers™	5763**		6830	8.45
	24 x 0.5 ml PCR microtubes	5763**		6020	7.45
	24 x 0.4 ml microtubes	5764**		6740	8.35
	24 x 0.25 ml microtubes	5764**		5860	7.25
851 ²	24 x 1.5 ml	-	8500	6740	8.35
	24 x 0.6 ml B/D Microtainers™	5763**		6830	8.45
	24 x 0.5 ml PCR microtubes	5763**		6020	7.45
	24 x 0.4 ml microtubes	5764**		6740	8.35
	24 x 0.25 ml microtubes	5764**		5860	7.25
852 ²	48 x 0.5 ml PCR microtubes	-	8500	6460	8.00†
				6060	7.50‡
	24 x B/D Microtainers™	-		6950	8.60†
853 ²	40 x 0.4 ml microtubes	-	8500	6790	8.40
	40 x 0.25 ml microtubes	-		6060	7.50
	40 x 0.8 ml (6x50 mm) glass	-		6870	8.50

Microtainers® is a registered trademark of Becton Dickinson

** Order 2 pks of adapters separately. IEC 5763 and 5764 are packaged 12/pk.

† Outer row holds 24 tubes

‡ Inner row holds 24 tubes

1 IEC 891 Rotor Provides Aerosol Containment and has been tested for microbiological containment by PHLS-CAMR, Porton Down. Meets requirements of US OSHA Bloodborne Pathogen Final Rule: (Regulation 29 CFR Part 1910.1030. Complete with IEC 50417 Aerosol Containment Cover, IEC 50525 Inner and IEC 36597 Outer rubber O-ring seals.

2 IEC 851, 852, 853 rotors

245 Horizontal Rotor 4x250 ml

(Use requires 50968 tapered shaft adapter)

No. of Tubes x Tube Size	Max Tube Size		Ultrac Adapter	Max RPM	Max RCF xg	Radius (cm)
	O.D. mm	L. mm				
40 x 1.5 ml microtubes	-	-	7228	2750	1375	16.2
40 x 3 ml	10.9	75	7228	2750	1450	17.2
48 x 5 ml	12.1	131	7226	2750	1450	17.2
5-7 ml (13 x 75-100mm vacutainers)	13.3	131	7238	2750	1450	17.2
28 x 10-15 ml vacutainers	16.2	110	7225	2750	1450	17.2
16 x 15 ml Falcon Conical	-	-	7230	2750	1475	17.6
12 x 30 ml	25.5	131	7223	2750	1450	17.2
4 x 50 ml	28.6	131	7231	2750	1450	17.2
4 x 50 ml Falcon/Corning Conical	-	-	7231	2750	1450	17.2
4 x 175 ml (Falcon 2076)	61.0	131	*	2750	1475	17.6
4 x 200 ml (Nunc 376813)	61.0	131	**	2750	1475	17.6
4 x 225 ml (Falcon 2075)	61.0	131	*	2750	1475	17.6
4 x 250 ml (IEC 2502, 2504)	61.0	131	-	2750	1500	17.8

* Also order Falcon 2090 cushions

**Also order IEC 5792 cushions

224/268 Horizontal Rotor 4x250 ml

(Use requires 50968 tapered shaft adapter)

No. of Tubes x Tube Size	Max Tube Size		Ultrac Adapter	Max RPM	Max RCF xg	Radius (cm)
	O.D. mm	L. mm				
40 x 1.5 ml microtubes	-	-	7228	4000	2450	13.7
40 x 3 ml	10.9	75	7228	4000	2630	14.7
48 x 5 ml	12.1	106	7226	4000	2630	14.7
40 x 7 ml	13.3	106	7236	4000	2630	14.7
28 x 7-10 ml	16.2	106	7225	4000	2630	14.7
12 x 15 ml Falcon Conical	-	-	7234	4000	2700	15.1
12 x 30 ml	25.5	106	7223	4000	2630	14.7
4 x 50 ml	28.6	110	7222	4000	2630	14.7
4 x 50 ml Falcon Conical	-	-	7231	4000	2630	14.7
4 x 75 ml (IEC 2059)	38.1	112	7221	4000	2630	14.7
4 x 175 ml (Falcon 2074)	61.0	125	*	4000	2700	15.1
4 x 250 ml (IEC 2261, 2051)	61.0	125	-	4000	2736	15.3

* Also order Falcon 2090 cushions

958 Horizontal Rotor 6x50 ml

(Use requires 50968 tapered shaft adapter)

No. of Tubes x Tube Size	Max Tube Size		TR. Ring	Carrier or Shield	Max RPM	Max RCF xg	Radius (cm)
	O.D. mm	L. mm					
48 x 5 ml	13.6	92	-	381	2600	1125	15.0
36 x Shell vial	17.7	77	-	379	2900	1300	13.7
36 x 7 ml	17.7	88	-	380	2600	1125	15.0
30 x 5 ml	12.6	98	366	369	3200	1600	14.0
24 x 7 ml	14.2	106	366	1018	2800	1375	15.7
18 x 10 ml	16.5	110	366	1013	2800	1400	15.9
24 x 10 ml	17.2	103	354	356	2400	1025	16.1
18 x 10 ml	17.2	112	355	356	2450	1075	16.1
6 x 15 ml	17.2	119	310	356	2950	1575	16.1
6 x 15 ml	17.2	134	310	303	2700	1475	17.6
12 x 50 ml	30.0	120	326	320	2400	1100	16.9
6 x 50 ml	30.0	124	325	320	2800	1475	16.8
6 x Microscope Slides	1"	3"	-	1025	1800	500	13.5

Hemato-Kit Rotor 930

(Use requires 1116 hub adapter on 50968 tapered shaft adapter)

The 930 Hemato-Kit can convert the CL3 Series into a micro-hematocrit centrifuge, providing a simple, economical way to perform occasional hematocrits. Blood cells are packed in about ten minutes, at 7800 RPM/6200 xg. Kit includes numbered 24-place rotor for 1.75 x 75 mm capillary tubes, 1505 gasket for tubes, cover, hub adapter and wrench for installing rotor. An accessory microcapillary tube reader available, to complete the system.

Order Cat. No. 930 Hemato-Kit and Cat. No. 2201 Microcapillary Tube Reader.

4.3 Derating Tables

Dense Samples

The Speed and Force Tables list the maximum speed for each rotor/adaptor combination for the CL3 Series. These speeds are guaranteed, for samples whose specific gravity is not greater than:

- 1.2 for swinging bucket rotors
- 1.5 for fixed angle rotors

For denser samples, the maximum guaranteed speed is reduced (derated) by a factor from the table below:

Derating Factor for:		
Specific Gravity	Swinging Bucket	Fixed Angle
1.2	1.000	1.000
1.3	.960	1.000
1.4	.925	1.000
1.5	.894	1.000
1.6	.866	.967
1.7	.839	.939
1.8	.816	.912
1.9	.794	.888
2.0	.774	.866
2.1	.755	.844
2.2	.738	.825
2.3	.721	.807
2.4	.707	.790
2.5	.692	.774
2.6	.678	.758
2.7	.666	.744
2.8	.654	.731
2.9	.642	.719
3.0	.632	.707

Derating Example: An angle rotor, rated for 10,000 RPM, used with samples with a specific gravity of 1.6, cannot spin faster than 9,670 RPM. ($10,000 \times .967 = 9,670$)

Specific gravities greater than 3.0. This table is based on the formula:

$$\sqrt{(S_o/S_a)}$$

You can use the same formula to compute derating factors for specific gravities greater than 3.0.

- S_o is the maximum specific gravity allowed before derating (1.2 or 1.5, depending on the type of rotor).
- S_a is the actual specific gravity of the sample.

Caution: Do not exceed the rated speed or specific gravity. Higher speeds or specific gravities will impose unnecessary wear on the centrifuge, and can cause **rotor failure**. **Wear and damage caused in this manner are not covered under warranty.**

244 Rotor

The 244 rotor is designed for centrifugation of multi-well microplates. The weight of the loaded microplates must be equally distributed between the rotor's two carriers. The maximum rated speed for the 244 rotor, when each of the carriers is loaded with 280 grams (total load of 560 grams), is 4000 rpm.

Caution: Loads greater than 280 grams (weight of the microplate and sample) must have maximum speed derated (according to the following table), to avoid **rotor failure**.

Derating Table for 244 Rotor	
Load per Carrier (grams)	Max. Speed (rpm)
280	4000
300	3600
320	3300
340	3000
360	2800
380	2600
400	2400
450	1900
500	1400
600	800
Greater than 600	do not use

4.4 Chemical Resistance Table

The CL3 Series is made of materials that are designed to resist attack from most laboratory chemicals. A variety of materials, including aluminum and polypropylene, comprise the rotors and accessories. The Chemical Resistance table shows the suitability of each material, with different classes of reagents.

Note: Chapter 5 describes how to clean and remove corrosion from the chamber, rotors, and accessories. Follow the instructions, and clean spills promptly, to minimize the effect of corrosive chemicals and avoid expensive repairs.

	Plastic										Metal					Other			
	PA	PC	PE	PP	PU	NL	DN	CN	NN	PS	TI	SS	AL	MB	MG	RR	BN	VN	PF
Acids, dilute or weak	E	E	E	E	G	E	F	N	F	E	G	G	F	F	N	F	E	E	E
Acids*, strong or conc.	E	N	E	E	F	N	N	N	N	F	N	N	N	N	N	N	F	G	N
Alcohols, aliphatic	E	G	E	E	F	E	E	E	N	E	E	E	E	E	F	E	E	G	E
Aldehydes	G	F	G	G	G	G	G	G	F	N	E	E	E	E	E	E	N	E	E
Bases	E	N	E	E	N	G	N	G	F	E	E	E	E	E	E	G	G	N	N
Esters	G	N	G	G	N	E	G	G	E	N	E	E	E	E	E	N	N	N	E
Hydrocarbons, aliphatic	G	F	G	G	E	N	E	E	E	N	E	E	E	E	E	N	E	E	E
Hydrocarbons, aromatic	F	N	G	F	N	N	E	E	E	N	E	E	E	E	E	N	N	E	E
Hydrocarbons, halogenated	F	N	F	F	N	N	G	E	G	N	E	E	E	E	N	N	N	F	E
Ketones	G	N	G	G	N	N	E	E	E	N	E	G	G	G	E	N	N	N	E
Oxidizing Agents, strong	F	N	F	F	N	N	N	N	N	N	E	F	N	N	N	N	F	E	E
Salts	E	E	E	E	E	E	E	E	E	E	E	F	F	F	N	E	E	E	E

*For Oxidizing Acids, see "Oxidizing Agents, strong".

PA - POLYALLOMER

PC - POLYCARBONATE

PE - POLYETHYLENE

PP - POLYPROPYLENE

PU - POLYURETHANE

NL - MODIFIED PHENYLENE OXIDE (NORYL)

DN - ACETAL HOMOPOLYMER (DELFIN)

CN - ACETAL COPOLYMER (CELCON)

NN - NYLON

PS - POLYSTYRENE

TI - TITANIUM

SS - STAINLESS STEEL

AL - ALUMINUM

MB - MANGANESE BRONZE

MG - MAGNESIUM

RR - RUBBER

BN - BUNA-N

VN - VITON

PF - PHENOLIC FIBER

Classification of Resistance

E= Excellent

G= Good

F= Fair

N= Not Recommended

4.5 Decontamination Table

Compatible Processes For Decontamination																				
Sterilization Methods	Plastic										Metal					Other				
	PA	PC	PE	PP	PU	NL	DN	CN	NN	PS	TI	SS	AL	MB	MG	RR	BN	VN	PF	PT
Mechanical																				
Autoclave*	S	M	U	S	M	U	S	S	S	U	S	S	S	S	S	S	S	M	S	M
Ethylene Oxide Gas	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	U	U	S	S	S
Dry Heat 160°C@2Hrs.	U	U	U	U	U	U	U	U	U	U	S	S	U	S	S	U	U	U	U	U
Chemical																				
Ethanol	S	S	S	S	U	S	S	S	U	M	S	S	S	S	S	S	S	S	S	S
40% Formalin	S	S	S	S	U	S	S	S	S	U	S	S	S	S	S	S	U	S	S	S
Methanol	S	M	S	S	M	S	S	S	U	M	S	S	S	S	S	S	S	U	S	S
2-Propanol	S	S	S	S	M	S	S	S	U	S	S	S	S	S	M	S	S	S	S	S
5% Sodium Hypochlorite**	S	S	S	S	U	S	U	U	U	S	S	M	U	U	U	S	U	S	S	M
3% Hydrogen Peroxide	S	S	S	S	S	S	M	S	U	S	S	S	S	S	U	S	S	S	S	M
100% Hydrogen Peroxide	S	S	S	S	S	U	U	U	U	S	S	S	S	S	S	U	U	S	S	U
5% Phenol Solution	M	U	U	S	U	U	M	M	U	M	M	M	M	M	M	M	U	S	S	U

*For Oxidizing Acids, see "Oxidizing Agents, strong".

PA - POLYALLOMER

PC - POLYCARBONATE

PE - POLYETHYLENE

PP - POLYPROPYLENE

PU - POLYURETHANE

NL - MODIFIED PHENYLENE OXIDE (NORYL)

DN - ACETAL HOMOPOLYMER (DELFIN)

CN - ACETAL COPOLYMER (CELCON)

NN - NYLON

PS - POLYSTYRENE

TI - TITANIUM

SS - STAINLESS STEEL

AL - ALUMINUM

MB - MANGANESE BRONZE

MG - MAGNESIUM

RR - RUBBER

BN - BUNA-N

VN - VITON

PF - PHENOLIC FIBER

PT - PAINTED SURFACES

*Autoclaving

121°C 20 min. @

2 ATM (15 PSIG)

**Household Bleach

S=SATISFACTORY

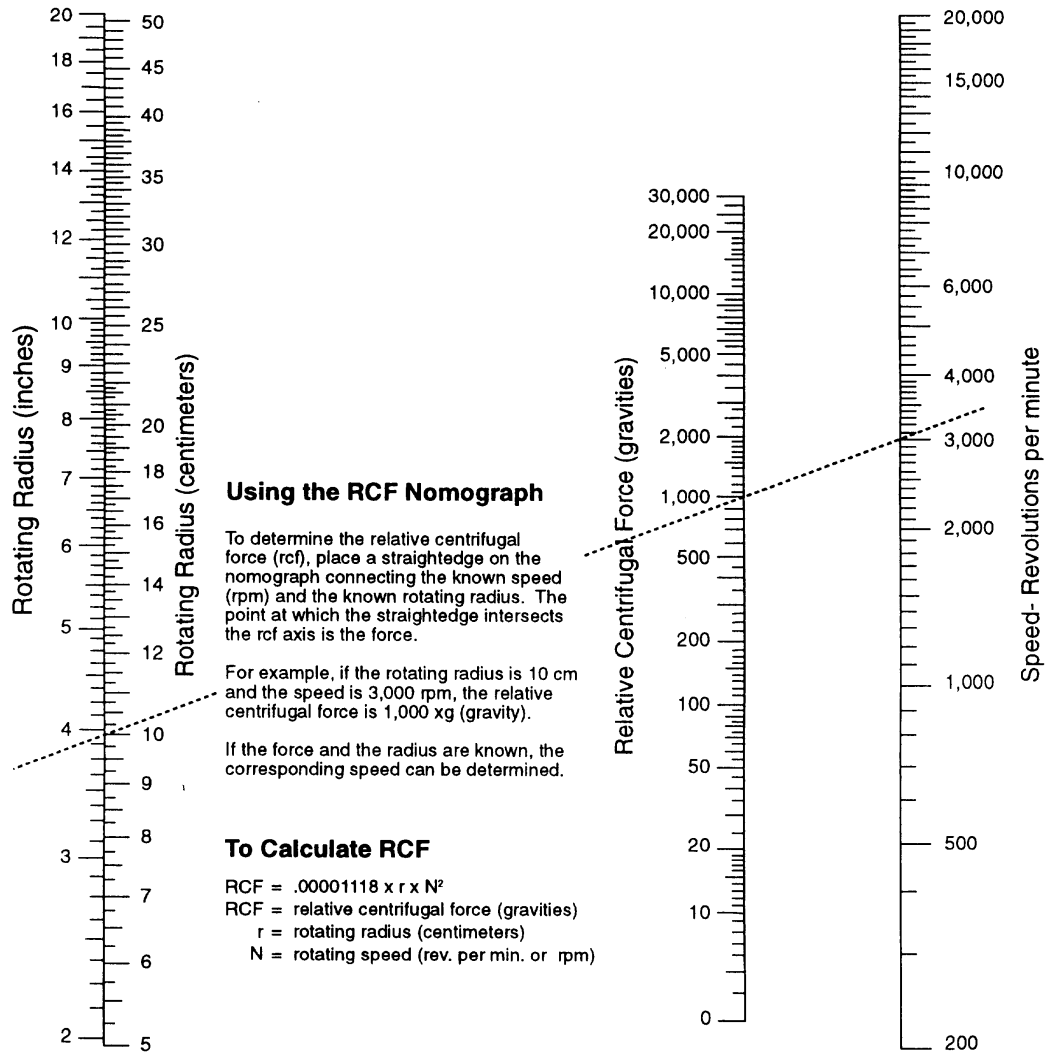
M=MARGINAL

U=UNSATISFACTORY

Warning:

This chart describes the material compatibility of various sterilization methods. It does not specify the adequacy of sterilization. Refer to section 4.4 - **Chemical Resistance Table**, for material compatibility during centrifugation.

4.6 RCF Nomograph



5 Maintenance

5.1 Introduction

This chapter explains how to keep your unit in good operating order. It includes instructions for cleaning, decontaminating, and storing. This chapter, also, covers the cover interlock bypass.

See the end of the chapter, for information on service and warranties.

5.2 Care and Cleaning

Keep your centrifuge clean, to ensure good operation, and to extend its life.

Clean the sample chamber, rotor, and lid, at the end of each work day, and immediately after any spill. To clean the chamber, use a damp sponge, warm water, and a mild liquid detergent, suitable for washing dishes by hand, such as Ivory® liquid. Do not use caustic detergents, or detergents that contain chlorine ions. These attack metals.

Remove stubborn stains with a plastic scrub pad. Do not use steel wool, wire brushes, abrasives, or sandpaper. They create corrosion sites. Never pour water directly into the rotor chamber.

Scrub the rotor's tube cavities with a stiff test tube brush that has end bristles and a non-metallic tip. Dry each part, after cleaning, with a clean, absorbent towel.

If glass breakage occurs, remove all broken pieces immediately. If breakage recurs, replace all adapters and cushions. Particles of broken glass embed in the plastic or rubber accessories. Glass particles can come in contact with new glass tubes, creating pressure points that may result in breakage recurring. Glass particles, in the chamber, grind to a fine gray dust, during centrifugation. This dust can coat the inside of the centrifuge.

Corrosion

IEC manufactures and finishes rotors and structural accessories to give maximum resistance to corrosion. To maximize the life of the unit, continually inspect the rotor cavities for corrosion, especially if you use chloride ion solutions, such as sodium chloride (saline), and sodium hypochlorite (household bleach), because these solutions attack most metals. Clean the rotor, rotor chamber, and accessories (particularly the sample compartments and bucket cups) thoroughly, after each exposure. Inspect all surfaces, under bright light, for corrosion. Be aware that small crevices grow deeper, eventually resulting in system failure.

Replace the shaft, locking nut, rotor, or accessories, if they become corroded, cracked, deformed, or gouged.

If you see any corrosion, remove it immediately, using the following procedure:

1. Follow the cleaning procedure, at the start of this section.
2. Soak the product in mild hand dish washing detergent, and scrub the product thoroughly with a stiff test tube brush. The brush should have end bristles and a non-metallic tip.
3. Soak the product, again, in clear warm water, for a minimum of an hour.
4. Rinse the product in warm water, then in distilled water.
5. Dry the product, thoroughly, with a clean, absorbent cloth.

Caution: If this procedure does not remove the corrosion, discontinue use of the product.

Storage

Store parts on a soft surface, to avoid damage. Rotors and other parts should be clean and dry. Store them open to the air, not in a plastic bag, so that any residual moisture evaporates. Face the parts upward, to avoid moisture retention in the cavities.

Decontamination

If tube breakage occurs, releasing toxic, infectious, pathogenic, or radioactive material into the unit, decontaminate the chamber.

Rotors have sealed containers, that provide aerosol containment and, if used as directed, keep spillage confined. If breakage occurs, it may be sufficient to only decontaminate the sealed carriers.

The Decontamination Table, in Chapter 4, lists the sensitivity of various materials to common sterilization procedures. When using a 1-to-10 dilution of household bleach (sodium hypochlorite), to decontaminate metal rotors or accessories, follow decontamination by the corrosion cleaning procedure (See 5.2), since chloride ions attack most metals.

Always decontaminate for the minimum recommended time. If you observe corrosion, remove it, as described earlier; discontinue use of the method; and use an alternate decontamination procedure.

Polypropylene sealed carriers can be autoclaved. Remove any sample tubes, before autoclaving, unless they are completely full of sample. Remove caps, stoppers, and other tube closures, before autoclaving, to keep the tubes from collapsing under pressure. Autoclave the rotor and accessories at 121 ° C @ 15 psig for 20 minutes. Do not stack polypropylene rotors during this process. After cooling, perform a normal cleaning operation, as described above.

Repeated autoclaving seriously degrades the performance of polycarbonate sealing covers.

5.3 Cover Interlock Bypass

The cover will remain locked, if power fails. If you need to remove samples from the unit, before power is restored, use the cover interlock bypass, after the rotor has come to a stop.

To bypass the cover interlock:

1. Unplug the centrifuge.
2. Locate the hidden plastic plug, underneath the ledge below the IEC CL3 logo.
3. Use a screwdriver to remove the plug.
4. Pull the attached cord, to release the cover interlock.
5. Replace the plug in the hole.

Do not perform this operation routinely. The centrifuge's cover interlock provides operator safety. It allows the cover to be opened promptly, whenever rotation has stopped.

5.4 Condition of Returned Equipment

Contact IEC, or your dealer, and obtain a return goods authorization (RGA), before returning equipment to IEC. The RGA paperwork includes a Certificate of Decontamination for you to sign. It indicates that you have performed the proper steps for decontaminating your unit.

Warning: All returned units must be decontaminated, free of radioactivity, and free of hazardous, infectious, pathogenic, or toxic materials.

IEC refuses all return equipment shipments, until the signed certificate is received.

You must prepay transportation to the service depot.

5.5 Warranty

IEC wants you to be satisfied with the quality of your CL3 Series centrifuge. We warranty your IEC centrifuge for one year, and IEC rotors for seven years. We will repair or replace any of these products that fail, within this period, from the date of its delivery, due to defects in material and workmanship, and we will ship you the repaired product or its replacement at our expense. You must use IEC-approved rotors and accessories, and genuine IEC spare parts. This warranty does not apply to any instrument that has been repaired without authorization or abused.

THE FOREGOING OBLIGATIONS ARE IN LIEU OF ALL OTHER OBLIGATIONS AND LIABILITIES INCLUDING NEGLIGENCE, AND ALL WARRANTIES, OF MERCHANTABILITY OR OTHERWISE, EXPRESSED OR IMPLIED IN FACT OR BYLAW. THE FOREGOING STATES OUR ENTIRE AND EXCLUSIVE LIABILITY, AND BUYER'S EXCLUSIVE REMEDY, FOR ANY CLAIM OR DAMAGES IN CONNECTION WITH THE SALE OR FURNISHING OF GOODS OR PARTS, THEIR DESIGN, SUITABILITY FOR USE, INSTALLATION, OR OPERATION. IEC WILL IN NO EVENT BE LIABLE FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES WHATSOEVER AND OUR LIABILITY UNDER NO CIRCUMSTANCES WILL EXCEED THE PURCHASE PRICE FOR THE GOODS FOR WHICH LIABILITY IS CLAIMED.

6 Specifications

Maximum Speed:	8,500 RPM (841 fixed angle rotor) 4,000 RPM (243 swinging bucket rotor)
Maximum Force:	6,200 xg (930 fixed angle rotor) 3,200 xg (243 swinging bucket rotor)
Maximum Number of Tubes:	48 x 5 ml sealed (243 rotor) 12 x 25 ml Universal sealed (243 rotor) 20 x 15 ml Falcon/Corning sealed (243 rotor) 8 x 50 ml Falcon/Corning sealed (243 rotor) 4 x 250 ml (243 rotor) 4 x Microplates/2 x Deep plates (244 rotor)
Maximum Sample Volume:	1 liter (243 rotor)
Operator Controls:	
Chamber Temperature*:	-9° C to 40° C, by 1 C°
Speed:	0 - 8,500 RPM, by 100 RPM
Spin Duration:	0:01 through 0:59, by 1 second 1:00 through 4:45, by 15 seconds 5 through 99 min., by 1 min. Momentary operation mode Hold mode (indefinite duration) At-Start timing mode At-Speed timing mode
Repeatability:	
Temperature*:	± 1 C° in the range from +4° C to +22° C
Rotation:	to 10 RPM
Motor:	Brushless DC
Refrigerant*:	HP-80, CFC-free

Power Requirements

Voltage:

3750 - 120V/60 Hz
3751 - 220-240V/50/60 Hz
3755 - 120V/60 Hz
3756 - 220-240V/50 Hz
3757 - 220-240V/60 Hz

Full specification compliance is guaranteed for up to $\pm 5\%$ line voltage specified.

Function guaranteed up to $\pm 10\%$ of line voltage

Operating Current:

3750 - 5.5 AMPS
3751 - 3 AMPS
3755 - 10 AMPS
3756 - 5 AMPS
3757 - 5 AMPS

Heat Output:

(max)

CL3: 1500 BTU/Hr
CL3R: 2700 BTU/Hr

Dimensions (CL3R)

Sample Loading Height: 32 cm (12.5 in)
Cover Closed Height: 37 cm (14.5 in)
Cover Open Height: 84 cm (33 in)
Width: 68 cm (26.5 in)
Depth: 53 cm (21 in)
Weight:
(shipping weight) 68 kg (150 lbs)
(net weight) 46 kg (100lbs)

Dimensions (CL3)

Sample Loading Height: 32 cm (12.5 in)
Cover Closed Height: 37 cm (14.5 in)
Cover Open Height: 84 cm (33 in)
Width: 49 cm (19.25 in)
Depth: 53 cm (21 in)
Weight:
(shipping weight) 91 kg (200 lbs)
(net weight) 68 kg (150 lbs)

Sound Level: 60 db(A) max.

Specifications Subject To Change Without Notice

*** CL3R Only**

7 Service

7.1 Warnings and Cautions

Warnings

The following hazards exist in servicing the CL3 Series:

The units use AC power. Some of the service procedures require operation with the cabinet or control panel off, exposing power lines. This introduces the risk of electrical shocks. Do not touch exposed wires without first unplugging the unit.

There is no power switch that provides a safe alternative to unplugging the unit.

The On/Off switch, on the control panel, activates the display. Turning this switch off **does not** remove power from the circuit board or any other internal components. Some components on the circuit board operate at high voltage. Do not touch board components when the power cord is plugged in.

The CL3R use pressurized refrigerant gases that are potential asphyxiants. All maintenance on the refrigeration unit should be performed in a well-ventilated area. If it becomes necessary to discharge or recharge the refrigeration system, this operation should be performed only by specially trained personnel with proper recovery systems.

The power cord(s) provided with these units are correctly rated for the highest current demand. Do not exchange the supplied cord with cords from other equipment. Exchange of power cords between equipment may create a fire hazard.

Cautions

An additional hazard to the equipment is as follows:

The circuit board contains electronics that can be damaged by static electricity. Persons doing extensive maintenance on the circuit board, or removing individual components from the circuit board, should be grounded (such as by wearing a wrist strap). When shipping a circuit board, always enclose it in a static-protective bag.

7.2 Special Tools

No special tools are required. A multimeter is required to perform diagnostics.

7.3 Troubleshooting

Use the following chart to help identify the source of service problems:

- I. Motor won't start, display shows 'Err 1' error.**
 - A. Unplug the unit plug, then plug the unit back in.
 - B. Spin rotor by hand and look at display to verify tachometer function.
 - C. Check motor. See section 11.1.
 - D. Check speed sensor. See section 11.2.
 - E. Check brake resistor. See section 11.5.
- II. Cover won't open when stop/open key is pressed.**
 - A. Check cover solenoid resistance. See section 8.3.
 - B. Remove front control panel and check latch/solenoid linkage for binding.
 - C. Check PC Board for power to solenoid. See section 8.3.
- III. Cover won't stay upright when opened.**
 - A. Check the gas spring of the cover. See section 8.4.
- IV. Unit vibrates when running or 'bal' is displayed on control panel.**
 - A. Check that samples and accessories are balanced inside chamber (use scale to verify) not only across the rotor, but also about the pivot axis of each bucket.
 - B. Try running unit without buckets, (rotor only) if vibration stops check buckets for matched weights to within 1 gram (including adapters and cushions).
 - C. Check buckets for fit and pivot ability (swing action). Contact IEC and discontinue using unit if buckets seem tight on the rotor pivot pins.
 - D. Clean rotor-bucket pivot points and lubricate with IEC lubricant part # 07133.
 - E. Check that centrifuge is placed on a level, vibration free surface (work bench).
 - F. Check motor mounts for wear or play.
 - G. Check motor shaft for any sign of bending (T.I.R. < 0.002").
 - H. Check for operation at observed critical speeds (between 1800-2200 rpm), and adjust speed if possible.
 - I. Verify calibration of imbalance sensor (**only** if machines does **not** exhibit excessive vibration).
- V. Unit does not seem to brake.**
 - A. Check that brake function is selected.
 - B. Check operation by timing stopping time with and without brake on. See section 11.5 if with brake time is not less than without.

8 Cabinet

8.1 Control Panel Removal

Removal of the control panel allows access to many internal components. Follow this procedure to remove the control panel:

1. Unplug the unit.
2. Remove the 1 Phillips screw from the bottom center edge of the control panel.
3. Gently pull the bottom of the panel outward and slide the panel downward to disengage the clips holding it in place.
4. Place the panel down, in front of the unit, taking care not to damage any of the wire harnesses.

8.2 Cabinet Housing Removal

Use the following procedure to remove the cabinet housing:

1. Unplug the unit.
2. Remove the front control panel. (see Section 8.1)
3. Disconnect all wiring from the Logic/Display PC Board.
4. Disconnect the wiring to the solenoid from connector J12 from the Power PC Board.
5. Disconnect the two leads (ORG and WHT) connected to the fan located on the left side of the cabinet.
- 6a. On **Ventilated Units**: Remove the 8 Phillips head screws around the underside of the cabinet housing.
- 6b. On **Refrigerated Units**: Remove the side grill by unscrewing the 6 Phillips head screws. Remove the 10 Phillips head screws around the underside of the cabinet housing.
7. Lift off the cabinet housing, the cover, and the latch assembly as
1 unit. (Removing the unit may be easier with the cover closed).

Note: If you need to activate the refrigeration system with the cabinet removed, be sure the centrifuge is in manual mode (blank program display) and short together the latch switch wires leading to the Logic PCB. Wrap electrical tape around the shorted wires to protect the PCB from any inadvertent damage.

Warning: Do not run the centrifuge without the cabinet/cover assembly. The cover/cabinet and interlock provide the user with protection against the rotating parts inside the chamber.

8.3 Latch Assembly

The latch assembly consists of a latch, a switch, linkage, and a solenoid. The cover striker engages the latch, and when the latch is locked in the closed position, the solenoid plunger activates the switch. The switch senses the status of the cover (open, closed/locked). The solenoid, when activated, releases the latch.

Latch problems should be narrowed down to the faulty component, if possible. Otherwise, replacement of the entire assembly is necessary. For example, a cover that does not open can be a faulty solenoid, binding linkage, or even a faulty PCB.

Latch Assembly Replacement

To remove/replace the latch assembly (which includes the latch, switch, solenoid & linkage):

1. Unplug the unit.
2. Remove the front control panel (see Section 8.1).
3. Remove the connector J5 from the Logic/Display PC board.
4. Disconnect the solenoid wiring at connector J12 on the Power PC board.
5. Remove the 2 ½" bolts that secure the latch assembly to the cabinet.
6. Reassemble with the new latch assembly. (Use the wiring diagram in the back of the manual as a reference for the position of the wires).

Latch

The latch may require replacement, if it is difficult to engage the striker. Try to adjust the striker on the lid, prior to replacement (see Section 8.4 Cover Assembly, for information on adjustment). The cover striker should engage the latch as easily as activating the latch by hand.

To replace the latch:

1. Remove the front control panel (see Section 8.1).
2. Disconnect all connectors to the latch assembly.
3. Loosen the retaining nut that secures the solenoid.
4. Slide the solenoid out.
5. Remove the link arm and bypass cord from the latch.
6. Remove the 3 ½" bolts that secure the latch to the bracket.
7. Reassemble the new latch.

Test the Switch

The CL3 has one interlock and switch. The switch can be tested using the following procedure:

1. Remove the front control panel (see Section 8.1).
2. Disconnect connector J5 on the Logic/Display PC board, located behind the control panel.
3. Use a multimeter to measure the resistance across the BRN and BLK leads at J5.
 - The switch should read open, when the cover is open.
 - The switch should read closed, when the cover is closed.
4. If the readings are not as expected, verify by measuring the switch directly (i.e. not through the harness) using the wiring diagram as a reference.

The switch may be adjusted slightly by loosening its screws, holding in place, and re-tightening the screws. The actuator arm of the switch may also be adjusted (bent) to improve performance.

Switch Replacement

To replace the switch, use the following procedure:

1. Note the wiring to the switch and disconnect it.
2. Remove the two (2) small screws that secure the switch in place.
3. Reposition the new switch so that the actuator arm is located above the roll pin of the solenoid plunger. Align it so that the conditions mentioned above ('Test the Switch') are both met.
4. Secure it with the screws. Refer to wiring and latch diagrams at the end of this manual for proper wire locations.

Solenoid

The solenoid releases the latch, when the cover open button is pressed and the rotor speed is at a safe, low speed (less than 100 rpm).

Test the Solenoid

Resistance of the solenoid coil should measure approximately 76Ω . This can be measured at J12 from the Power PC board, with the unit unplugged and the front panel removed, across the two white leads.

This procedure requires operation of the unit with power applied and the front panel removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

1. Remove the front control panel. See section 8.1.
2. Prepare to measure the DC voltage across the two WHT leads to the solenoid at J12 from the Power PC board. The expected value is 90Volts DC.
3. Plug the centrifuge in, close the cover and press the STOP/OPEN cover button to activate the solenoid. Power is applied for a fraction of a second.
4. If voltage is found on the Power PC board, but the solenoid does not activate the latch, check the linkage for binding, before replacing the solenoid.

Solenoid Replacement

To replace a faulty solenoid:

1. Remove the front control panel (see Section 8.1).
2. Disconnect the wiring to the solenoid.
3. Loosen the retaining nut.
4. Slide the solenoid out.
5. Unhook the link arm from the solenoid.
6. Slide the new solenoid into place.
7. Secure the retaining nut.
8. Reattach the wiring harnesses.

8.4 Cover Assembly

The cover assembly is secured to the cabinet housing by a hinge and a gas spring. The cover engages a gasket to keep the chamber sealed. This gasket keeps the refrigerated models from developing too much frost, and allows them to achieve maximum cooling efficiency and performance. This gasket is held in place by a friction fit. If it becomes loose or deteriorates over time, it should be replaced.

Non-refrigerated units (CL3) have an air baffle inside of the cover. This baffle contains a path for proper air circulation. If this path becomes blocked, the chamber and samples may overheat. Proper air flow can be verified by placing your hand over the vent holes along the back of the cover assembly. Air flow should be evident through these vents, but not along the sides of the cover.

Cover Adjustments

If the cover does not close easily, or if it must be pushed down to enable the unit to run, the latch switch or assembly may be loose, or the cover latch striker may need adjustment.

To adjust a cover latch striker:

1. Loosen the locking nut that holds it in place.
2. Adjust the striker by screwing it up or down, to correct its height for locking.
3. Be sure to lock it back into place by tightening the locking nut with a wrench. This will prevent it from loosening when the unit is in operation.

A properly adjusted cover will result in no Lid warning and no air leakage around the sides and front of the cover. Air flow from the rear of a ventilated unit is normal. To check the latch switch alignment, refer to Section 8.3.

Gas Spring Replacement

If the cover assembly does not stay up on its own, the cover gas spring may need to be replaced.

1. Remove the cabinet housing (see Section 8.2).
2. Pry off gas spring anchor cap.
3. Pop off the gas spring from the bracket that it is attached to at each end.
4. Reassemble with a new gas spring.

Note: The black portion of the gas spring should be visible when the lid is opened.

8.5 Guard Bowl

The centrifuge chamber is formed by the cover and guard bowl. The guard bowl is painted for easy care and cleaning.

Replacement

Use the following procedure to remove the guard bowl:

CL3:

1. Remove the cabinet (see Section 8.2).
2. Remove the rubber motor boot.
3. Remove the 4 mounting screws that hold guard bowl, to free it from the support legs.

On **CL3R** units, the guard bowl is part of the evaporator foam assembly. It cannot be removed without breaking into the refrigeration system.

The evaporator foam assembly can be raised slightly, to aid in replacement of the components mounted on the baseplate of the centrifuge. Use this procedure to raise the foam assembly:

1. Remove the cabinet (see Section 8.2).
2. Remove the 4 mounting bolts that hold the evaporator foam assembly to the support legs. The evaporator foam assembly can be slightly raised.
3. Use a screwdriver as a wedge, or place blocks under the edges of the steel ring, to hold the assembly up. This will bend the refrigeration tubing, so take care to avoid damage to the refrigeration system.

9 Power Circuit

9.1 General

The Power Entry Module is where power is applied to the centrifuge, via the power cord. A circuit breaker is at the right of the power entry module. **Power configuration is described in Section 2.3.**

Power Test

Use the following procedure to verify power to the PC boards:

This procedure requires operation of the unit with power applied and the front panel removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

1. Remove the front control panel (see Section 8.1).
2. With power applied, on the Power PCB (below guard bowl) measure the voltage across TP1 (GND) and TP4 (HV). Voltage should be approximately 170 volts DC.
3. On the Logic PCB (behind control panel) measure the voltage across TP4 (GND) and TP5 (+5VDC). Voltage should be approximately 5 volts DC.

If voltage is not present, use the wiring diagram to trace back through the line filter, circuit breaker, and power entry module, to locate any failed components.

9.2 Circuit Breaker

All models have 15 AMP circuit breakers. They are located on the lower left side of each unit, near the line cord. Once tripped, the circuit breaker stops power from being applied to the rest of the unit. The circuit breaker can be reset by pushing the plunger in the center of the circuit breaker back into place.

Test

If the circuit breaker continues to trip, follow this troubleshooting procedure:

This procedure requires operation of the unit with power applied and the front panel removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

1. Remove the front control panel (see Section 8.1).
2. Disconnect all connections to the Power PC board.
3. Apply power.

If the circuit breaker trips, search for a short in the circuit breaker, the power entry module, or the line filter.

4. If the breaker has not tripped, remove power, and connect J9 to the Power PC board and power the unit back on.
5. If the breaker does not trip, repeat step 4 for all the other connectors, one-by-one.
6. Once the breaker trips, search for a short in the last component that was connected.

Replacement

To remove the circuit breaker:

1. Remove the front control panel (see Section 8.1).
2. Remove the cabinet (see Section 8.2).
3. Remove the retaining clip that holds the circuit breaker in place.
4. Slide the circuit breaker out.
5. Disconnect the leads.
6. Insert the new circuit breaker in the same manner.

10 Printed Circuit Boards

10.1 General

Logic/ Display PC Board

The CL3 electronics consist of two circuit boards, the microcontroller logic board and the power board.

The microcontroller (Logic/Display) circuit board consists of the controlling microprocessor (68HC11 microcontroller) and associated memory, logic and display. The CL3 microcontroller is an embedded system design. The non volatile RAM in an extended memory map, allows the recall of programmed parameters, even after power line interruption. The membrane keyboard and user interface displays are integral to the embedded system design and under full microprocessor supervision.

On the Logic/Display circuit board, U13 is a 68HC11 microcontroller. It is an eight bit machine with synchronous ports for data and address busses. It also has synchronous and asynchronous serial ports, an eight bit general purpose I/O port, and a four input eight bit analog to digital converter.

The system control software is U10, a 27C256 EPROM. U12 is the nonvolatile RAM.

Power PC Board

The Power circuit board develops the motor and logic power supply voltage. In addition to the motor drive circuit, the Power circuit board supports the following systems: refrigeration, latch solenoid, motor blower, PC board blower, and the motor brake.

The drive motor is a brushless DC motor. Power is applied to the motor by the 3 phase sequencing of 6 MOSFET transistors. Only one pair of the MOSFETS is on at any given time.

PCB Test Points

PCB Test Points are as follows:

Logic PCB		Power PCB	
TP1	COP SET (5VDC)	TP1	GND
TP2	40 Hz	TP2	+5VDC
TP3	RESET (5VDC)*	TP3	+15VDC
TP4	+5VDC	TP4	HV (170VDC)
TP5	GND	TP5	5KHz
*Can cause FSafe Error when touched. To reset, unplug centrifuge, press and hold the stop key, and plug in centrifuge.		TP6	Tach (1Hz/10RPM)

Power PCB LEDs

+HV (DS9): This red LED indicates that motor voltage is present, 170 VDC. Rectification and pulse width modulation of the line power determine the average voltage applied to the motor.

FAULT (DS3): This red LED indicates when the motor is at rest. The FAULT LED measures the level of current being applied to the motor during acceleration. This LED is OFF at a steady state speed.

FANS (DS1): This green LED Indicates that the motor and the power board blowers are activated and remain activated for 20 minutes after the motor comes to rest.

COMP (DS2): This red LED indicates that the refrigeration drive circuit is activated. The refrigeration drive circuit includes a compressor and condenser fan which are wired in parallel. AC power is provided through the activation of an AC drive circuit, comprised of U3 and a solid state relay. LED (DS2) indicates whether the drive circuit is activated.

COV SOL (DS5): This red LED indicates when the motor is at rest and the drive circuit is activated. The solenoid retracts when energized to release the cover latch. AC power is provided through the activation of an AC drive circuit, comprised of U3 and Q3.

BRAKE (DS4): The red LED indicates when the brake circuit is activated.

10.2 Replacing the Circuit Boards

Use the following procedures to replace the Logic/Display PC board and the Power PC board.

The circuit boards contain electronics that can be damaged by static electricity. Persons replacing a circuit board, or removing individual components from the circuit board, should be grounded (such as by wearing a wrist strap).

Logic/Display PC Board Replacement

To replace the Logic/Display PC board:

1. Remove the front control panel (see Section 8.1).
2. Disconnect all connectors from the Logic PC board (to Power PCB, latch switch, thermistor, if present, and two to the membrane control panel).
3. Remove the six (6) Phillips head screws that secure the board in place.
4. Lift off the circuit board.
5. Replace and reassemble with the new Logic/Display PC board.
6. On initial power up (after replacement), press and hold the STOP key while plugging the centrifuge in. This is required to reset the microprocessor.

Power PC Board Replacement

To replace the Power PC board:

1. Remove the front control panel (see Section 8.1).
2. Disconnect all connectors from the Power PC board (to Logic PCB, pressure switch, if present, three FastOns to the motor, solenoid, brake resistor, power, and speed sensor).
3. Remove the 4 hex head screws (in the clamping bar) holding the heat sink in place.
4. Remove the 2 hex head screws on either side of the circuit board.
5. Gently slide the Power PCB forward to remove it from the rear brackets, and lift it out with the heat sink.
6. Replace and reassemble with new Power PC board.
7. Calibrate the imbalance sensor. See section 11.3.

Note: Power PC board must be secured into its two (2) rear mounting brackets (located below the guard bowl) in order for the imbalance sensor to be properly calibrated. Inspect the heat sink to be certain that the silpad (grey rubber tape) is intact, as the mosfets must be electrically isolated from the base. Also be sure to place the heat sink below the PCB mosfets and put the orange cushion (placed on top of the mosfets) under the clamping bar which secures the heat sink in place.

11 Drive Assembly

11.1 Motor

The CL3 drive assembly consists of a brushless DC motor with built in Hall effect speed sensors.

Some electrical motor characteristics can be checked, when the unit is unplugged. These procedures are outlined in this section.

Test

To measure the resistance of the motor, follow this procedure:

1. Remove the front control panel (see Section 8.1).
2. Remove the three (3) FastOn connectors from the motor to the Power PC board (RED, ORN, BRN).
3. Measure the following resistances:

Between RED ORN BRN $\sim 1 \Omega$ (any combination)

If any combination shows an open, replace the motor. If they are correct, measure the resistance of all the leads to the ground terminal (chassis). All three should be open when measured to ground.

To verify power is being applied to the motor, follow this procedure:

This procedure requires operation of the unit with power applied and the front control panel removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

1. Remove the front control panel. See section 8.1.
2. Measure across the RED, ORN, and BRN in any combination to measure the AC voltage. It may be necessary to raise up the FastOn from the terminal slightly, in order to take a reading.
3. Plug the unit in and verify that a rotor is properly installed.
4. Select an appropriate speed and time, select soft acceleration, and start a run.

Voltage should be present, but will fluctuate (a voltmeter with peak hold will confirm the presence of voltage). If no voltage is present, replace the Power PC board.

Motor Replacement

Use the following procedure to replace the motor:

1. Open the cover.
2. Unplug the unit.
3. Remove the rotor and all accessories.
4. Remove the black rubber motor boot.
5. Remove the front control panel (see Section 8.1).
6. Disconnect the 3 Fast-On connectors at J14A (RED), J14B (BRN), and J14C (ORG).
7. Disconnect the 6-pin connector at J13.
8. Remove the 4 bolts that secure the motor.
(A 10" extension, with a 5/16" magnetic socket will make this easier. Be careful not to drop the bolts.)
9. Lift the motor out.
10. Replace the motor in the same fashion, reversing the steps.

11.2 Speed Sensor

The speed sensor is comprised of three Hall effect sensors, which sense pulses from a magnetic disk mounted on the motor shaft. It does not require calibration or adjustment. Its accuracy (+/- 10 rpm) can be verified by strobing the motor shaft through the viewport in the cover.

Test

This procedure requires operation of the unit with power applied and the front control panel removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

Power to the speed sensor can be verified across test points TP1 (GND) and TP6 (Tach) of the Power PCB. Turning the motor shaft slowly should produce a fluctuation between 0 and 5VDC (square wave). The frequency output of the speed sensor can be measured across the same points using an oscilloscope or a multimeter with frequency capability. The speed sensor produces a frequency signal of 1 Hz/10RPM.

The speed sensor is an integral part of the motor assembly, and is not available separately. If tests to the speed sensor uncover a fault, the motor must be replaced (see Section 11.1).

11.3 Imbalance Sensor

The imbalance sensor is comprised of a PCB mounted Hall Effect sensor and a magnet/bolt assembly which extends from the motor mounting plate. If an unbalanced load produces excessive vibration, the magnet will activate the Hall Effect switch and trigger an imbalance error code. This can also occur for a variety of other reasons, including operator error. See Section 7.3, Troubleshooting, for ideas on how to correct imbalance problems prior to adjusting the factory calibration of the imbalance sensor.

The magnet, located on the bottom of the detector bolt, can be removed by simply prying it off by hand. Its own magnetic force keeps it secured. Due to the magnet's polarity, there is only one proper orientation for placement. Please note the orientation of the magnet before removal (or mark it with a felt pen to indicate the downward facing side of the magnet). An improperly installed magnet will make calibration of the sensor difficult.

Imbalance Sensor Adjustment

If the bAL error appears even if there is no excessive vibration, the imbalance sensor may need adjustment. Follow the procedure below to adjust the imbalance sensor:

This procedure requires operation of the unit with power applied and the front control panel removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

1. Place the unit into Self-Test mode by:
 - a. Press the Program Down Arrow to exit the program mode (Blank Display).
 - b. Press Power OFF.
 - c. Press arrows in the following order:
 - ◆ UP RPM
 - ◆ UP TIME
 - ◆ DOWN RPM
 - ◆ DOWN TIME
 - d. Press Power ON. (Display will indicate the software version "SF x.x").
2. Lower (screw down) the detector bolt/magnet assembly until a beep is heard.
3. Raise (unscrew) the detector bolt/magnet assembly until beeping stops. This positions the sensor at an initial (coarse) setting. Proceed on to properly calibrate it.
4. Press Power OFF.

To verify the calibration, the set speed should be at the highest critical speed in which the system will trip the imbalance sensor. The recommended speed when using a 243 rotor is 2200 RPM. Follow this procedure to verify the imbalance sensor adjustment:

This procedure requires operation of the unit with power applied and the front control panel removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

1. Press Power ON.
2. Set speed to 2200RPM.
3. Install the 4 place 243 rotor, and adjust the detector bolt/magnet assembly so that the following conditions are met:
 - Fully loaded with a 10 gram imbalance - **no imbalance indication**
 - Fully loaded with a 30 gram imbalance - **imbalance below 2000 RPM**
4. If the unit does stop with a 10 gram imbalance, adjust the detector bolt/magnet assembly up and repeat the test until both conditions are met.
5. If the unit does not stop with a 30 gram imbalance before the speed reaches 2000RPM, adjust the detector bolt/magnet assembly down and repeat test both conditions are met.

11.4 Blowers

There are two blowers in the CL3/CL3R. The motor blower is located behind the motor and the PC board blower is located on the front left side of the cabinet assembly. The motor blower and the PC board blower are wired in parallel. Both of these blowers are on during motor operation in the ventilated units, and are on, additionally, when the refrigeration systems is on in the refrigerated units. The blowers remain on for an additional 20 minutes after a run.

Testing the Motor Blower

Use this procedure to verify power to the motor blower:

This procedure requires operation of the unit with power applied and the front control panel removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

1. Remove the front control panel (see Section 8.1).
2. Disconnect the wires (ORG & WHT) at the PC Board blower mounted inside the cabinet, to the left of the control panel. This will isolate the motor blower (so that you hear only the motor blower).
3. Measure voltage across the two leads. Voltage should be approximately 120 volts AC.

Note: The blowers are activated whenever the motor is activated and/or whenever the refrigeration system is activated, and they continue to run for 20 minutes after a run. In order to test them, start a run, and then press stop. The motor blower should be easy to hear if it is running. Remember to set a refrigerated model for higher than ambient temperature (or open the cover) to avoid mistaking the condenser fan for the motor blower.

If voltage is present, but the motor blower is not blowing, replace the motor blower.

If voltage is not present, check the wiring for loose connections, and ensure that the FAN LED (DS1 - green) on the Power PCB is lit. The wiring can be traced back to J9, pins 2 (WHT) and 4 (ORG). If voltage is not present there, but the LED is lit, then replace the Power PCB.

Testing the PCB Blower

Use this procedure to verify power to the PC Board blower:

This procedure requires operation of the unit with power applied and the front control panel removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

1. Remove the front control panel (see Section 8.1).
2. Disconnect the wires (ORG & WHT) at the PC Board blower mounted inside the cabinet, to the left of the control panel.
3. Measure voltage across the two leads. Voltage should be approximately 120 volts AC.

If voltage is present and the PC Board blower is not blowing, when connected, replace the PC Board blower.

If voltage is not present, check the wiring for loose connections, and ensure that the FAN LED (DS1 - green) on the Power PCB is lit. The wiring can be traced back to J9, pins 2 (WHT) and 4 (ORG). If voltage is not present there, but the LED is lit, then replace the Power PCB.

Replacing the Motor Blower

To replace the motor blower:

1. Remove the cabinet assembly (see Section 8.2).
2. Locate the fan at the rear of the centrifuge and unscrew the 2 bolts that secure the blower bracket to the base.
3. Disconnect all wiring connections.
4. Remove the four bolts which secure the guard bowl assembly to the support legs (4).
5. On ventilated models, lift off the guardbowl. On refrigerated models, the guardbowl assembly is an integral part of the refrigeration system and cannot be removed without breaking into the refrigeration system. To facilitate fan removal, the guardbowl must be slightly lifted, using care, so as not to break the refrigeration lines. Use blocks or something similar to rest guardbowl on, once lifted.
6. Remove the blower and bracket, replace the motor blower and reassemble.

Note: On both ventilated and refrigerated units, the **motor blower air flow direction is INWARD** (see Diagrams).

Replacing the PC Board Blower

To replace the PC board blower:

1. Remove the front control panel (see Section 8.1).
2. Locate the PC board blower on the front left side of the cabinet.
3. Disconnect all wiring connections.
4. Remove the 3 bolts securing the PC board blower.
5. Replace and reassemble the PC board blower.

Note: The direction of the blowers differs between ventilated and refrigerated models.

- **Ventilated Units- PC board blower air flow direction is OUTWARD.**
- **Refrigerated Units- PC board blower air flow direction is INWARD.**

11.5 Brake

The brake applies reversed voltage to the motor during deceleration.

The brake requires service if, with a fully loaded rotor and operating at that rotor's maximum allowable speed, the deceleration time in the brake mode is not less than the deceleration time in coast (no brake).

Test

Use this procedure to verify operation of the braking system:

The following procedure requires operation of the unit with power applied and the front control panel removed. Use caution to avoid electric shock. See Section 7.1, Warnings and cautions.

1. Remove the front control panel (see Section 8.1).
2. Locate connector TP1(GND) and J11, pin 1 (RED) on the Power PCB.
3. Verify DC braking voltage across these locations. Expected measurement should be approximately 170 VDC.
4. Plug the unit in and verify that a properly loaded rotor is installed.
5. Select an appropriate speed and time, and start a run.
6. During a run, this voltage should drop slightly (3 - 10 VDC).
7. If voltage is not present, verify resistance of the brake resistor at J11 pins 1 (RED) and 3 (YEL). The expected value is approximately 50 Ω .
8. If the resistor is good, replace the Power PC board.

12 Refrigeration

12.1 General

The refrigeration system of the CL3R is capable of maintaining a 4° C guard bowl temperature at ambient temperatures up to 23° C. The unit should be able to maintain this temperature within $\pm 2^{\circ}$ C of the set point.

- CL3R features a 1/4 hp (@60 Hz) compressor. It uses 9.3 oz. of HP-80 (R402A) refrigerant.

In manual mode, refrigeration, if required, will operate when the unit is on and the lid is closed. In program mode, refrigeration will only operate if the program requires cooling and the start button is pressed.

Both refrigerated and ventilated models require ventilation for proper air flow. Allow a minimum of 8 cm (3 inches) clearance on all vented sides of the unit. Insure that the condenser fins and ventilation grill are free of dust and dirt. Do not operate the refrigeration system, if the condenser fan is not working correctly.

The compressor and condenser fan in the refrigerated unit are controlled by a solid state relay. The solid state relay acts as a switch which receives a low voltage signal (5VDC) from the Logic/Display PC board to either turn them on or off. The signal originates at the Display/Logic PC board and passes through the Power PC board which then supplies the low voltage and low current signal to the solid state relay coil. The relay contact is then made, providing 120VAC to the compressor and fan, thus turning them on. If the 5VDC signal from the Power PC board or the Display/Logic PC board is lost, the compressor will shut off.

12.2 Condensing Unit

Service of the condensing unit should be performed by qualified personnel only, with the proper refrigerant recovery systems.

The condensing unit consists of the compressor, the condenser fan and their related electrical components.

Test

Use the following procedure, to verify voltage to the condensing unit:

This procedure requires operation of the unit with power applied and the front panel removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

1. Remove the front control panel (see Section 8.1).
2. Remove the cabinet assembly (see Section 8.2).
3. Locate the electrical box of the condensing unit and remove the cover by removing the C-clip holding it in place.
4. Plug the unit in. {If you have the centrifuge in manual mode, and have the cover closed (switch shorted) the refrigeration system should be activated by setting a temperature below ambient. If the COMP LED does not come on, check the Logic PCB.}
5. Use a voltmeter to measure the AC voltage across the BLU and BLK wires going directly into the compressor.
6. The voltage applied to the compressor should be approximately 120 volts AC (or the actual in-line voltage).
7. If voltage is present, but the compressor does not start, check the starting capacitor.
8. If voltage is not present and the COMP LED on the Power PC board is lit, check the solid state relay (see Section 12.2).

12.3 Refrigeration Relay

The solid state relay (SSR) powers the compressor and condenser fan on a low voltage signal from the Power PCB. To test the SSR, use the following procedure:

This procedure requires operation of the unit with power applied and the front control panel removed. Use caution to avoid electric shock. See Section 7.1, Warnings and Cautions.

1. Remove the front control panel (see Section 8.1).
2. Remove the cabinet (see Section 8.2).
3. Measure the DC voltage across J10 of the Power PCB, pins 1 (RED) and 2 (GRY). When the refrigeration system is activated (COMP LED - DS2 green is lit), there should be 5 VDC present. If not, replace the Power PCB. {If you have the centrifuge in manual mode, and have the cover closed (switch shorted) the refrigeration system should be activated by setting a temperature below ambient. If the COMP LED does not come on, check the Logic PCB.}
4. If the 5 VDC is present, verify the voltage at the compressor or condenser fan. If voltage of 120VAC is not found at the compressor or condenser fan, check the Pressure Switch and look for any loose connections. If everything seems good, replace the relay.

12.4 Thermistor

The thermistor is located inside the chamber of the refrigerated units (CL3R). It is secured by a rubber grommet and is sealed into the foam below the chamber using RTV (silicon sealant). You can verify its operation by taking its resistance at various temperatures. Follow this procedure to do so:

1. Remove the front control panel (see Section 8.1).
2. Locate J6 connector on the Logic/ Display PC board and disconnect it.
3. Measure the resistance across pin 1 (YEL) and pin 3 (YEL) on the harness.
 - At 25° C (approx. room temperature) the resistance should be 2.25 k Ω .
 - At 0° C (achieved by packing ice around thermistor) the resistance should be 7.35 k Ω .

If these values are not verified, or if an open or short circuit are detected, the thermistor should be replaced.

Replace

Use the following procedure to replace the thermistor:

1. Open the cover.
2. Remove the front control panel (see Section 8.1).
3. Locate the thermistor inside the bowl, toward the front of the unit.
4. Remove the tape and any RTV (silicon sealant) which supports the thermistor inside the foam.
5. Push the thermistor down through the rubber grommet and out the bottom of the evaporator foam assembly.
6. Disconnect the harness.
7. Install the new thermistor in the same manner.
8. Reseal the thermistor in place, to ensure its proper operation.

12.5 Pressure Switch

The refrigerated units (CL3R) also includes a pressure switch. This pressure switch acts as a safety device for the refrigeration system. The pressure switch is brazed into the high pressure tubing run between the compressor and the condenser. If the pressure in the refrigeration system exceeds a pressure of 500 psi, the pressure switch will 'open', shutting the compressor off.

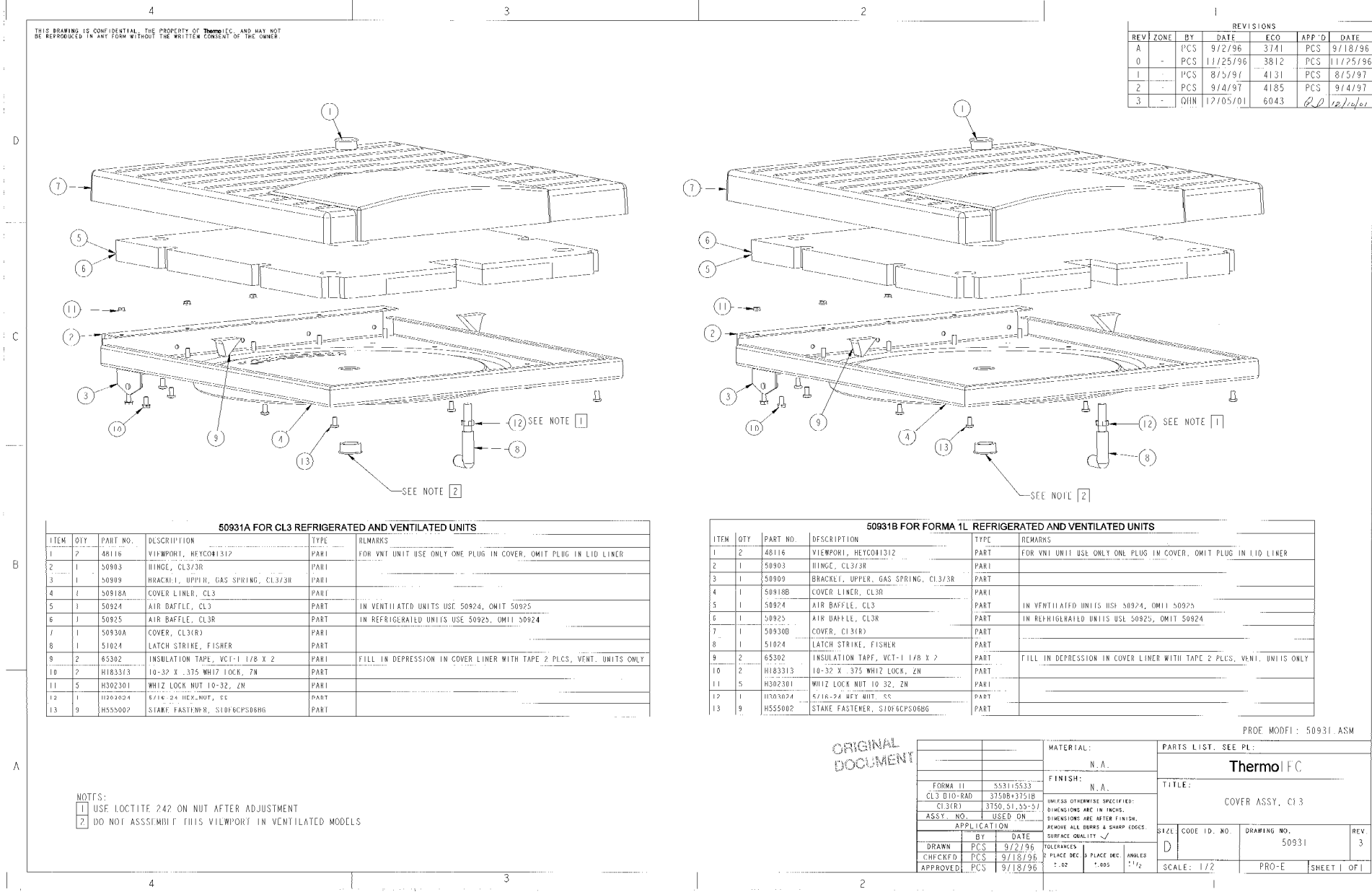
Replacement of the pressure switch should be done by a qualified refrigeration person.

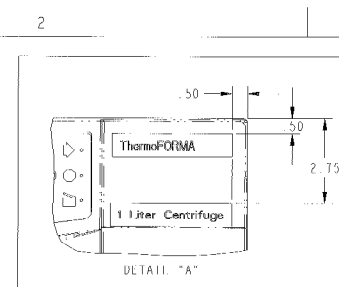
13 Drawings

Drawings included in this section are:

50931	Cover Assy. (<i>All models</i>)
50933	Control Panel Assy. (<i>All models</i>)
50929	Latch Assy. (<i>All models</i>)
3750	Main Assy. CL3
50940	Base Assy. CL3
3755	Main Assy. CL3R
50945	Base Assy. CL3R
10881	Wiring Diagram CL3
10882	Wiring Diagram CL3R
10880	Power PCB Schematic (2 pg.s)
44478A	Power PCB Layout
PL44478A	Power PCB Parts List (5 pg.s)
10879	Logic/Display PCB Schematic (2 pg.s)
44477A	Logic/Display PCB Layout
PL44477A	Logic/Display PCB Parts List (5 pg.s)

Note: At time of publication, these drawings were accurate. Changes do occur. If you have any questions regarding these drawings, contact IEC Technical Support at +(781) 449-8060.





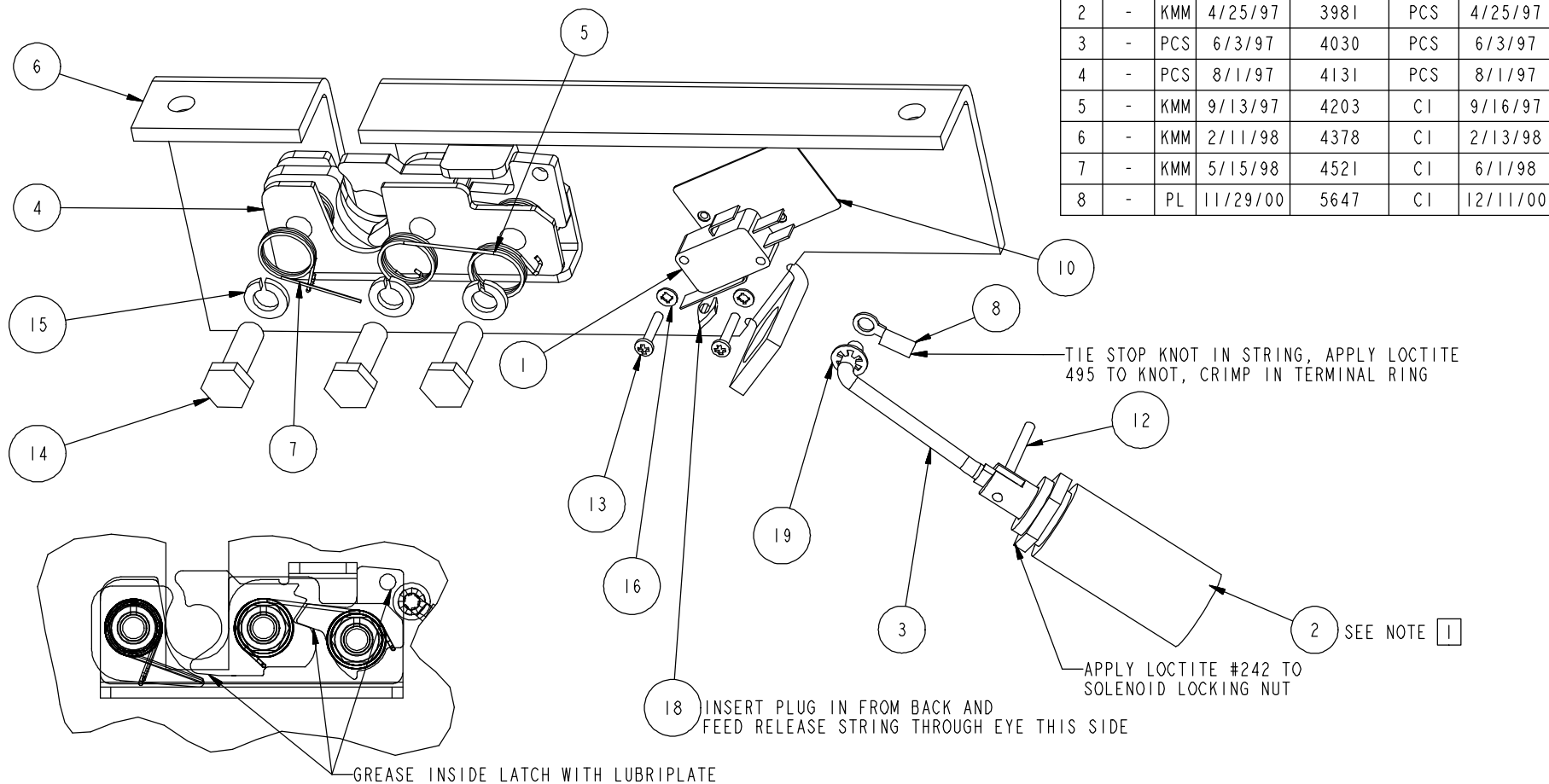
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0	-	PCS	11/25/96	5812	PCS	11/25/96
1	-	PL	4/4/01	5783	C1	5/3/01
2	-	PL	8/13/01	5914	RAD	8/21/01
3	-	QHN	12/05/01	6043	C1	12/10/01
4	-	PL	2/25/02	6083	RAD	2/25/02
5	-	PL	5/10/02	6117	C1	5/16/02
6	-	QHN	07/18/02	6240	<i>B.D.</i>	<i>7/24/02</i>

50933C FOR FORM A CL3 REFRIGERATED & VENTILATED UNITS					
ITEM	QTY	PART NO.	DESCRIPTION	TYPE	REMARKS
1	1	44477	DISPLAY/LOGIC PCB, CL3	PART	44477A FOR VENT. UNITS, 44477B FOR REFR. UNITS
2	2	50687	UPPER BEZEL BRACKET	PART	
3	1	50932	BEZEL, CL3(R)	PART	
4	1	56619	LABEL FORM A LITER	PART	
5	1	50916C	MEMBRANE, FORM A	PART	FOR VENT. UNITS
6	1	50916D	MEMBRANE, FORM B(LRIG	PART	FOR REFR. UNITS
7	1	COM1	LABEL THERMOFORM A	PART	
8	6	H110133	4 40 X .250 PAN HEAD PHIL. SS	PART	
9	4	H170000	#8 X 1/2 PLASTITE PAN HEAD	PART	
10	6	H424011	#4 INTERNAL LOCK WASHER, SS	PART	

50933D FOR CL3 BIO-HAD VENTILATED UNITS					
ITEM	QTY	PART NO.	DESCRIPTION	TYPE	REMARKS
1	1	44557	DISPLAY/LOGIC PCB, CL3 BIO-RAD	PART	
2	2	50687	UPPER BEZEL BRACKET	PART	
3	1	50916A	MEMBRANE, CL3	PART	
4	1	50932A	BF7L, CL3	PART	
5	6	H110133	4-40 X .250 PAN HEAD PHIL. SS	PART	
6	4	H110000	#8 X 1/2 PLASTITE PAN HEAD	PART	
7	6	H424011	#4 INTERNAL LOCK WASHER. SS	PART	

PROENGINEER MODEL 50933.ASM			DOCUMENT		
5531+5533 FORM A II 3750N & 3751B C13 R10-RAD 3750, 51, 55-51 C13 (R) ASSY. NO. USED ON			MATERIAL: N. A. FINISH: N. A. UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHS. DIMENSIONS ARE AFTER FINISH. REMOVE ALL BURRS & SHARP EDGES. SURFACE QUALITY ✓		
APPLICATION			PARTS LIST. SEE PL:		
DRAWN BY DATE CHECKED C1 05/01/01 APPROVED C1 05/01/01			TITLE: BEZEL ASSY C13(R)		
SIZE CODE ID. NO. D			DRAWING NO. 50933		
SCALE: 1/2			PRO-F		
SHEET 1 OF 1			REV. 6		

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REVISIONS						
REV	ZONE	BY	DATE	ECO	APP'D	DATE
2	-	KMM	4/25/97	3981	PCS	4/25/97
3	-	PCS	6/3/97	4030	PCS	6/3/97
4	-	PCS	8/1/97	4131	PCS	8/1/97
5	-	KMM	9/13/97	4203	CI	9/16/97
6	-	KMM	2/11/98	4378	CI	2/13/98
7	-	KMM	5/15/98	4521	CI	6/1/98
8	-	PL	11/29/00	5647	CI	12/11/00

ITEM	QTY	PART NO.	DESCRIPTION	TYPE	REMARKS
1	1	43754	MICROSWITCH	PART	
2	1	50634	SOLENOID	ASSEMBLY	SEE NOTE 1
3	1	50635	LINK ARM	PART	
4	1	50912	LATCH	ASSEMBLY	
5	1	50913	SPRING, LATCH	PART	DISCARD STOCK SPRING, REPLACE WITH 50913
6	1	50926	LATCH BRACKET	PART	
7	1	51022	SINGLE TORSION SPRING, FISHER	PART	DISCARD STOCK SPRING, REPLACE WITH 51022
8	1	COML	#10 TERMINAL RING, AMP PN 34149	PART	
9	1	COML	ADHESIVE LOCTITE 242	BULK ITEM	
10	1	COML	INSULATOR PAD, #15PA177-V7	PART	
11	1	COML	LUBRIPLATE 630 AA	BULK ITEM	
12	1	COML	ROLL PIN, 1/8 DIA, 1 LG SST	PART	
13	2	H110105	4-40 X .625 PAN HEAD PHIL, SS	PART	
14	3	H133320	5/16-18 X 1.000 HEX HEAD, SS	PART	
15	3	H419102	5/16 LOCK WASHER SPLIT, SS	PART	
16	2	H424011	#4 INTERNAL LOCK WASHER, SS	PART	
17	1	H509002	POLYESTER 50LB TEST FISHING LINE	BULK ITEM	26" LENGTH, DOUBLE UP
18	1	H703003	HEYCO CLIP, #0311	PART	LEAD RELEASE STRING THROUGH PLUG
19	1	H850015	#8 TINNERMAN	PART	

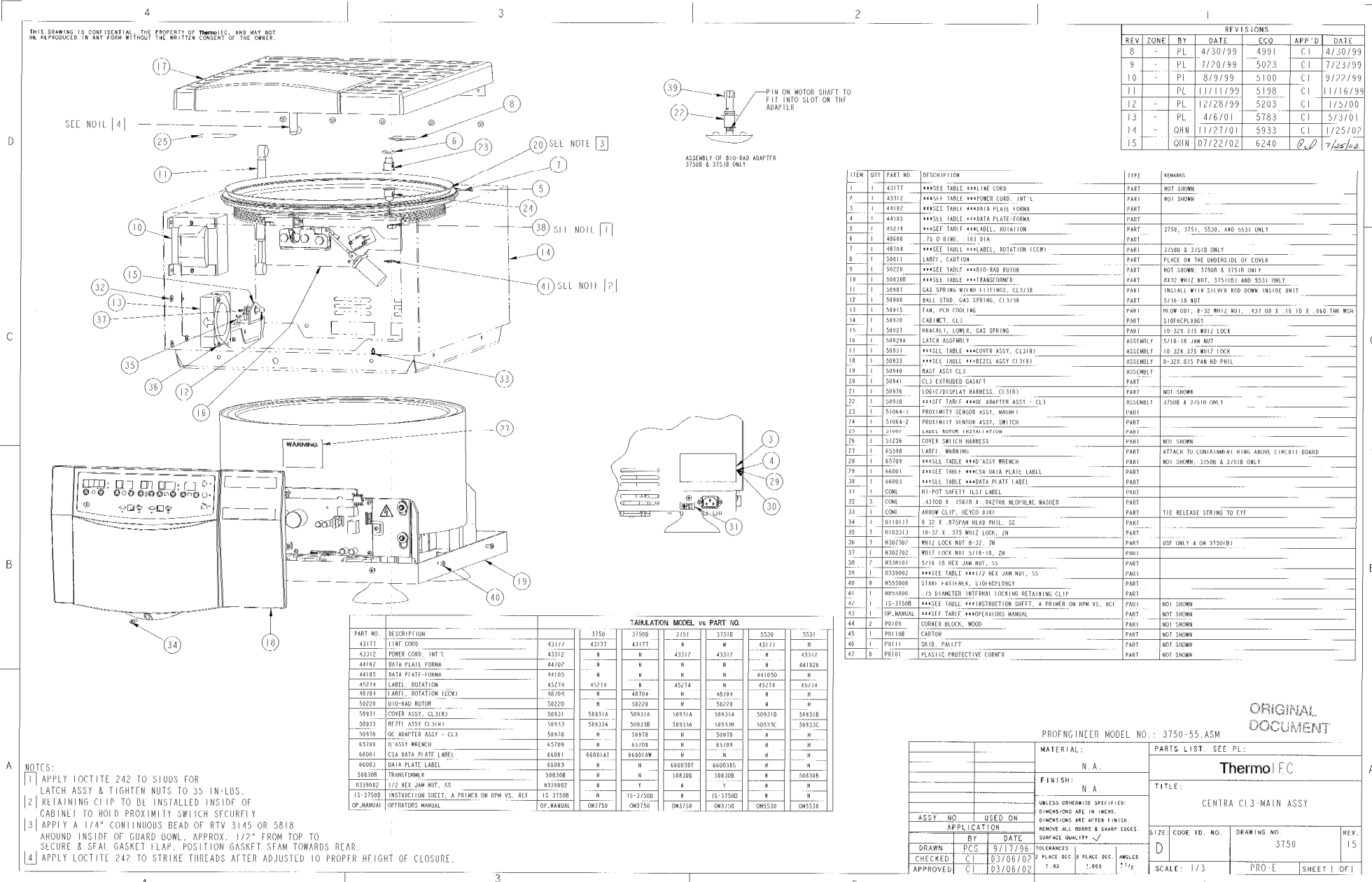
NOTE(S):

1 50929A TO USE 50634C; 50929B TO USE 50634D

PROENGINEER MODEL 50929.ASM

		MATERIAL:		PARTS LIST. SEE PL:	
		N.A.		INTERNATIONAL EQUIPMENT CO.	
		FINISH:		TITLE:	
		N.A.		LATCH ASSEMBLY	
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHS. DIMENSIONS ARE AFTER FINISH. REMOVE ALL BURRS & SHARP EDGES. SURFACE QUALITY ✓		SIZE:		CODE ID. NO.	DRAWING NO.
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				±1/2	
SCALE: 1/1		PRO-E		SHEET 1 OF 1	

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ITEM	QTY	PART NO.	DESCRIPTION	TYPE	REMARKS
1	1	10081	SCHEMATIC DIAGRAM	PART	NOT SHOWN
2	1	44495C	IMBALANCE DETECTION PCB, C13 & 32001K	PART	6-32X.375 PH HD PL, 55L, 3H ODV, 16 IDE, 13 TH, NYLON WDM
3	4	47448	SUCTION CUP 1001	PART	7/16-14 UNC 3 T, .80 X 1.0621TTF 5N2
4	1	50127	LABEL PROTECTIVE EARTH GROUND SYMBOL	PART	
5	3	50128	LABEL SECONDARY CHASSIS GROUND SYMBOL	PART	
6	1	50605C	GROUND WIRE	PART	NOT SHOWN
7	1	50662	GUARD BOWL ASSY, 15 IN. VENT.	ASSEMBLY	
8	1	50980	MOTOR, BRUSH FSS, DC	PART	8-32X.375 WHIZ LOCK
9	1	50982A	MOTOR HOOD	PART	
10	4	50984	SUPPORT LEGS, CL3/3R	PART	1/4-20X.500 WHIZ LOCK; 10-32X.500 WHIZ LOCK
11	1	50985	SUPPORT PLATE, MOTOR, CL3/3R	PART	1/4-20 WHIZ NOT
12	4	50986	ISOLATOR	PART	1/4-20 WHIZ NOT
13	1	50987A	BASE, CL3	PART	3/50(B) X 3/15(B) ONLY
14	1	50988	BASE, FORMA CL3	PART	5001 ONLY
15	1	50988	HOIF PLUG	PART	3/50(B) ONLY
16	1	50987	BRACKET, FAN	PART	8-32X.375 WHIZ LOCK
17	1	50933	FAN, MOTOR	PART	#10 SFF, TAP, FAN BLOWS IN
18	1	50950A	MAIN HARNESS CL3	PART	NOT SHOWN
19	1	50951	POWER HARNESS CL3(R)	PART	NOT SHOWN
20	1	50952	WEAR RESISTION HARNESS	PART	NOT SHOWN
21	1	50955	TRANSFORMER HARNESS	PART	NOT SHOWN, 375(B) X 5531 ONLY
22	1	51063	POWER ENTRY MODULE	PART	RIVET IN PLACE
23	1	51071	MOTOR BOOT SEAL RING	PART	1/4-20X.375 ROUND HD PHIL, SS
24	1	51322	IMBALANCE PCB HARNESS, (EC MP(LR))	PART	NOT SHOWN
25	2	51399	BRACKET, PCS	ASSEMBLY	1/4-20X.500 WHIZ LOCK, ZN
26	1	51402	SHIELD, PCB	PART	8-32X.312 PH HD PHIL, SS
27	1	51403	ELECTRONIC BOARD ASSY'S	ASSEMBLY	SEE DETAIL A
28	1	51404	ADAPTER PLATE, MOTOR	PART	10-32X.375 WHIZ LOCK, ZN
29	4	51416	SHOULDER WASHER	PART	
30	1	51421A	GROUND WIRE HARNESS	PART	NOT SHOWN
31	1	51477	NYLON SHIM, PCB	PART	
32	1	60430A	MOTOR BRUSH RESISTION	PART	8-32X.375 WHIZ LOCK
33	1	60615	CAPACITOR ASSY, HIGH VOLT	PART	8-32 X.375 WHIZ LOCK; 375(B) X 5531 ONLY
34	1	62607	LINE FILTER - 20 AMPS	PART	8-32 X.375 WHIZ LOCK; 375(B) ONLY
35	1	62612	FILTER	PART	8-32X.375 WHIZ LOCK; 375(B) ONLY
36	2	62713N	FLUORENCE INK - 15 AMP	PART	1.00 X 3/50(B) 3.00 X 3/50(B) X 5531
37	1	COM	ALL PURPOSE SPRAY LUBRICANT	ORLN FILM	F.O. STABTETT W, NOT SHOWN SEE NOTE 3
38	2	H101114	6-32 X .312 PH HD PHIL, SS	PART	
39	2	H10127	6-32 X .312 PH HD PHIL, SS	PART	
40	2	H120690	10-32X 1/2 SELF TAPPING B	PART	
41	4	H124100	1/4-20 X .375 ROUND HD PHIL, SS	PART	
42	4	H133274	1/16-14 X 1.000 IN-X HEAD, SS	PART	
43	6	H135305	1/4-20 X .500 WHIZ LOCK, ZN	PART	
44	4	H133307	10-32 X .500 WHIZ LOCK, ZN	PART	
45	4	H133313	10-32 X .375 WHIZ LOCK, ZN	PART	
46	15	H133318	8-32 X .375 WHIZ LOCK, ZN	PART	
47	4	H300100	10-32 HEX LOCK NUT, SS W/ NYLON INSERT	PART	
48	8	H302701	WHIZ LOCK NUT 1/4-20, ZN	PART	
49	4	H401804	.750 OD X .710 ID X .125 TH, NYLON WASHER	PART	
50	2	H401814	.375 OD X .156 ID X .125 TH, NYLON WASHER	PART	
51	4	H401907	#10 FLAT WASHER, .750 OD X .203 ID X .063 TH	PART	
52	4	H424103	#8 INTERNAL LOCK WASHER, SS	PART	
53	4	H425101	#8 EXTERNAL LOCK WASHER, SS	PART	

1. USE LOCTITE 242 ON NUTS ATTACHING ISOLATORS TO BASE PLATE AND SUPPORT PLATE, 8 PLCS & 10 SCREWS ATTACHING MOTOR ADAPTER PLATE TO MOTOR, 4 PLCS.

2. APPLY LOCTITE 502 TO SCREWS USED TO FASTEN MOTOR BOOT AND SHAFT RING TO MOTOR AND TO HEX HD SCREWS WHEN ATTACHING SUCTION FEET-4 PLCS. SPRAY LUBRICANT ON SHAFT AND WIPE OFF EXCESS

3. USE THIS WHIZ-LOCK SCREW TO SECURE 60615(CAP ASSY) TO BASE.

4. PLACE NYLON SHIM AT CENTER OF PCB BOARD ASSEMBLY FACING THE GUARDBOWL.

5. GROUND LOCATION FOR 51421A WIRE HARNESS.

6. GROUND PER Thermo IEC SPEC 355/3, 4-PLCS.

DETAIL II SCALE 1/1 SEE NOTE 7

INSERT TERMINAL RING AFTWRN WASHERS

DETAIL A SCALE 1/1

DETAIL B SCALE 1/1

DETAIL C SCALE 1/1

DETAIL D SCALE 1/1

DETAIL E SCALE 1/1

DETAIL F SCALE 1/1

DETAIL G SCALE 1/1

DETAIL H SCALE 1/1

DETAIL I SCALE 1/1

DETAIL J SCALE 1/1

DETAIL K SCALE 1/1

DETAIL L SCALE 1/1

DETAIL M SCALE 1/1

DETAIL N SCALE 1/1

DETAIL O SCALE 1/1

DETAIL P SCALE 1/1

DETAIL Q SCALE 1/1

DETAIL R SCALE 1/1

DETAIL S SCALE 1/1

DETAIL T SCALE 1/1

DETAIL U SCALE 1/1

DETAIL V SCALE 1/1

DETAIL W SCALE 1/1

DETAIL X SCALE 1/1

DETAIL Y SCALE 1/1

DETAIL Z SCALE 1/1

REVISIONS

REV	ZONE	BY	DATE	ECO	APP'D	DATE
5	-	KMM	2/11/98	4318	CI	2/13/98
6	-	CI	4/20/98	4476	CI	4/23/98
7	-	PL	7/7/98	4597	CI	7/10/98
8	-	PL	11/19/98	4811	CI	11/28/98
9	-	KMM	1/5/99	4828	CI	1/13/99
10	-	PI	4/9/99	4985	CI	4/23/99
11	-	PL	8/9/99	5100	CI	9/22/99
12	-	PL	11/3/99	5188	CI	12/15/99
13	-	PL	5/2/00	5386	CI	5/3/00
14	-	PI	5/1/01	5783	CI	5/3/01
15	-	QIN	08/20/01	5933	CI	10/17/01

ORIGINAL DOCUMENT

SCANNED

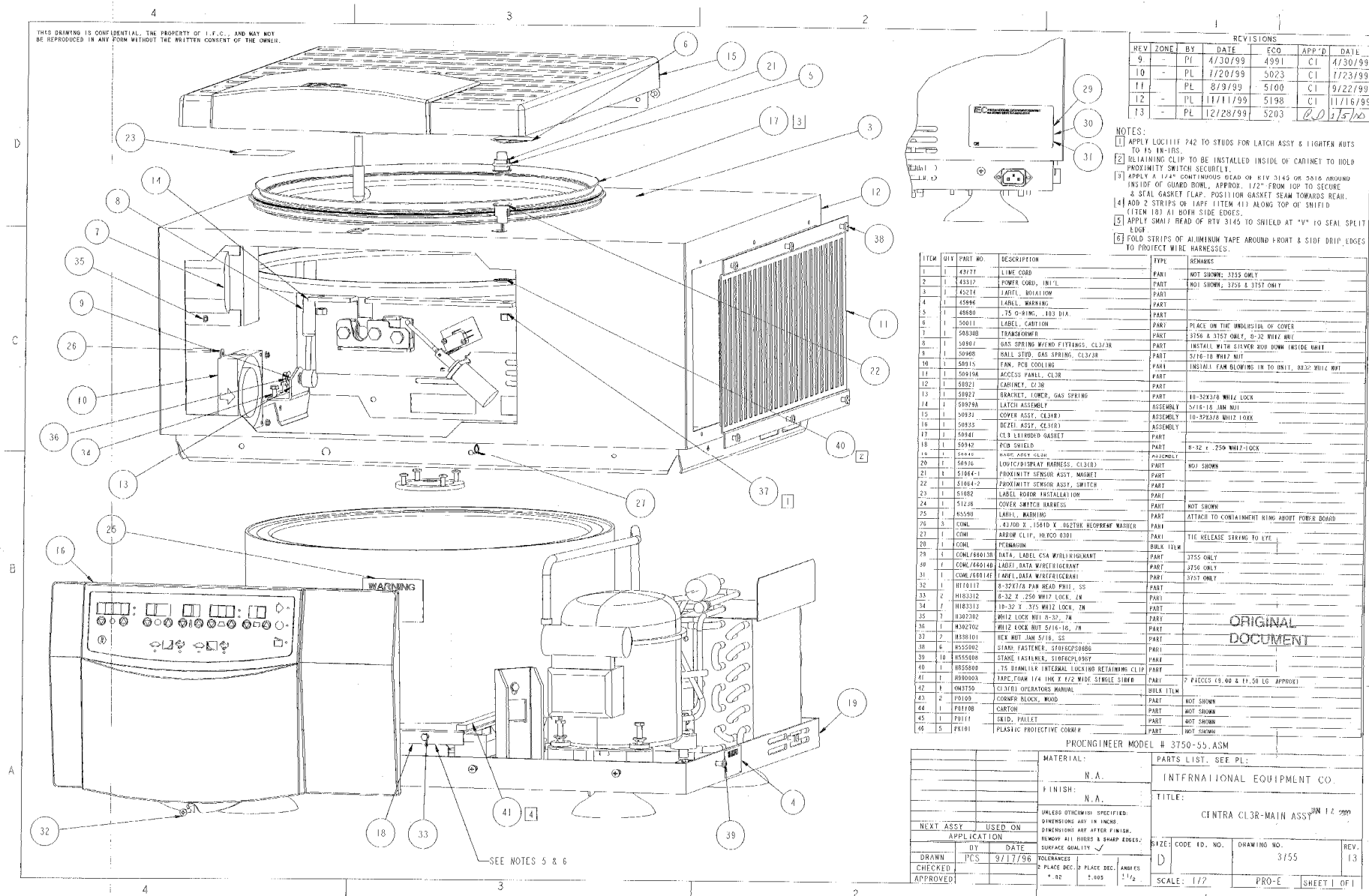
PROENGINEER MODEL # 50940-45.ASM

MATERIAL:		PARTS LIST. SEE PL:		
N.A.		ThermoIEC		
FINISH:		TITLE:		
N.A.		BASE ASSY CL3		
UNLESS OTHERWISE SPECIFIED:		DIMENSIONS ARE IN INCHES		
DIMENSIONS ARE AFTER FINISH		REMOVE ALL BURRS & SHARP EDGES		
SURFACE QUALITY		SURFACE QUALITY		
APPLICATION		APPLICATION		
BY	DATE	BY	DATE	
PCS	9/8/96	PCS	9/8/96	
CHECKED	CI	05/03/01	CI	05/03/01
APPROVED	CI	05/03/01	CI	05/03/01

SIZE	CODE ID. NO.	DRAWING NO.	REV.
D		50940	15
SCALE: 1/3		PRO F	SHEET 1 OF 1

Printed: 08-28-2002

Tel.: +(781)449-8060 Fax: +(781)455-9749



4

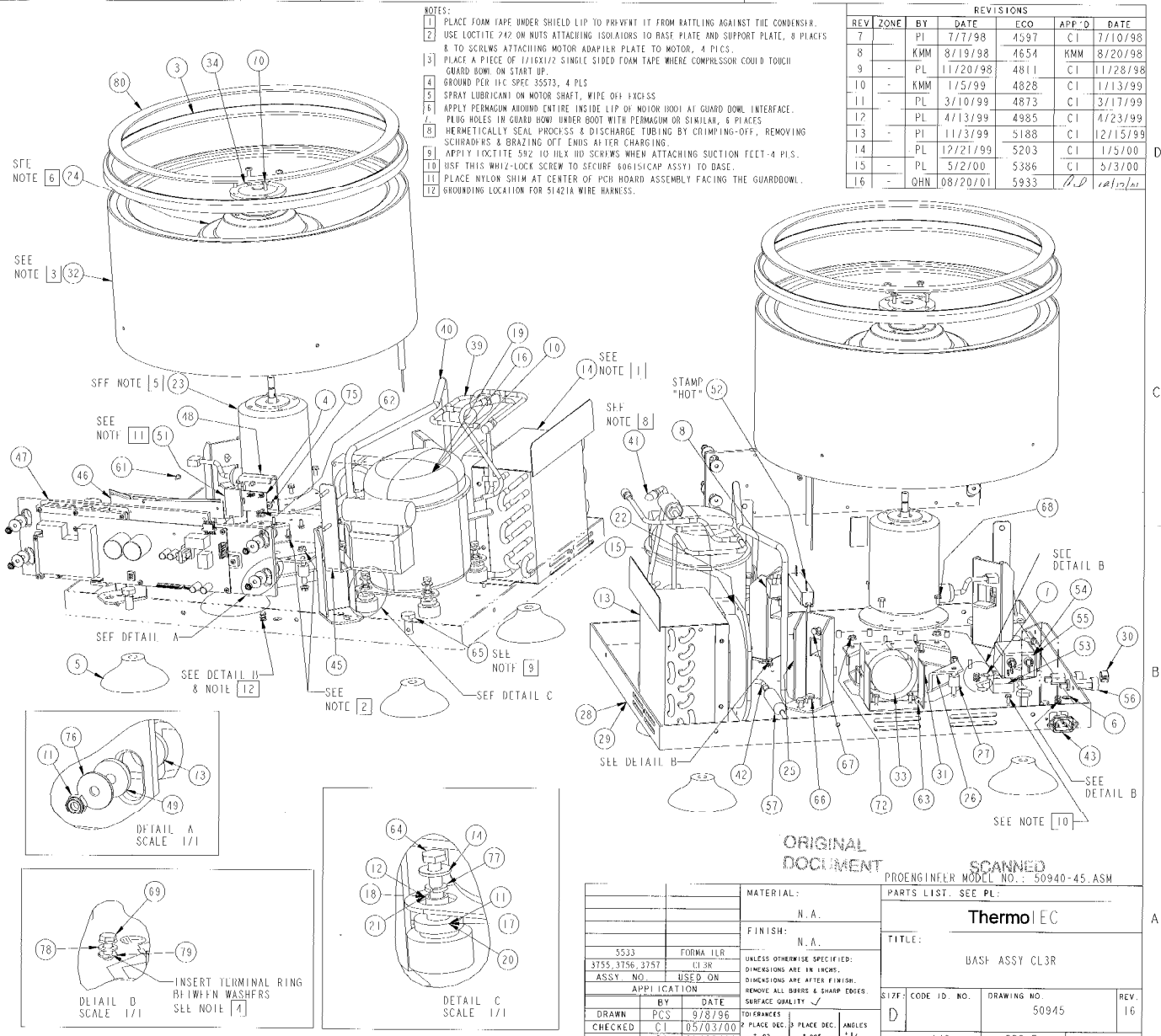
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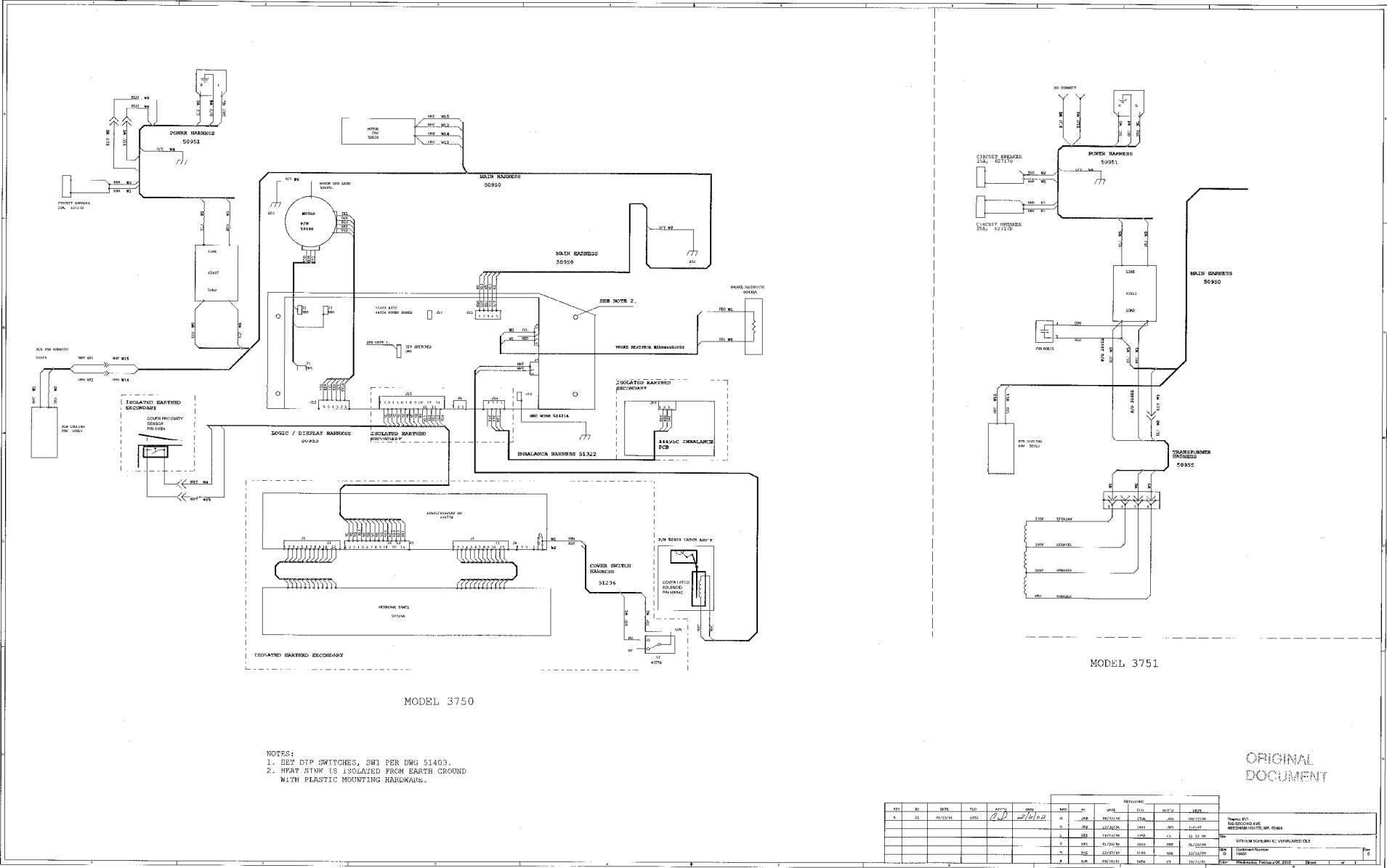
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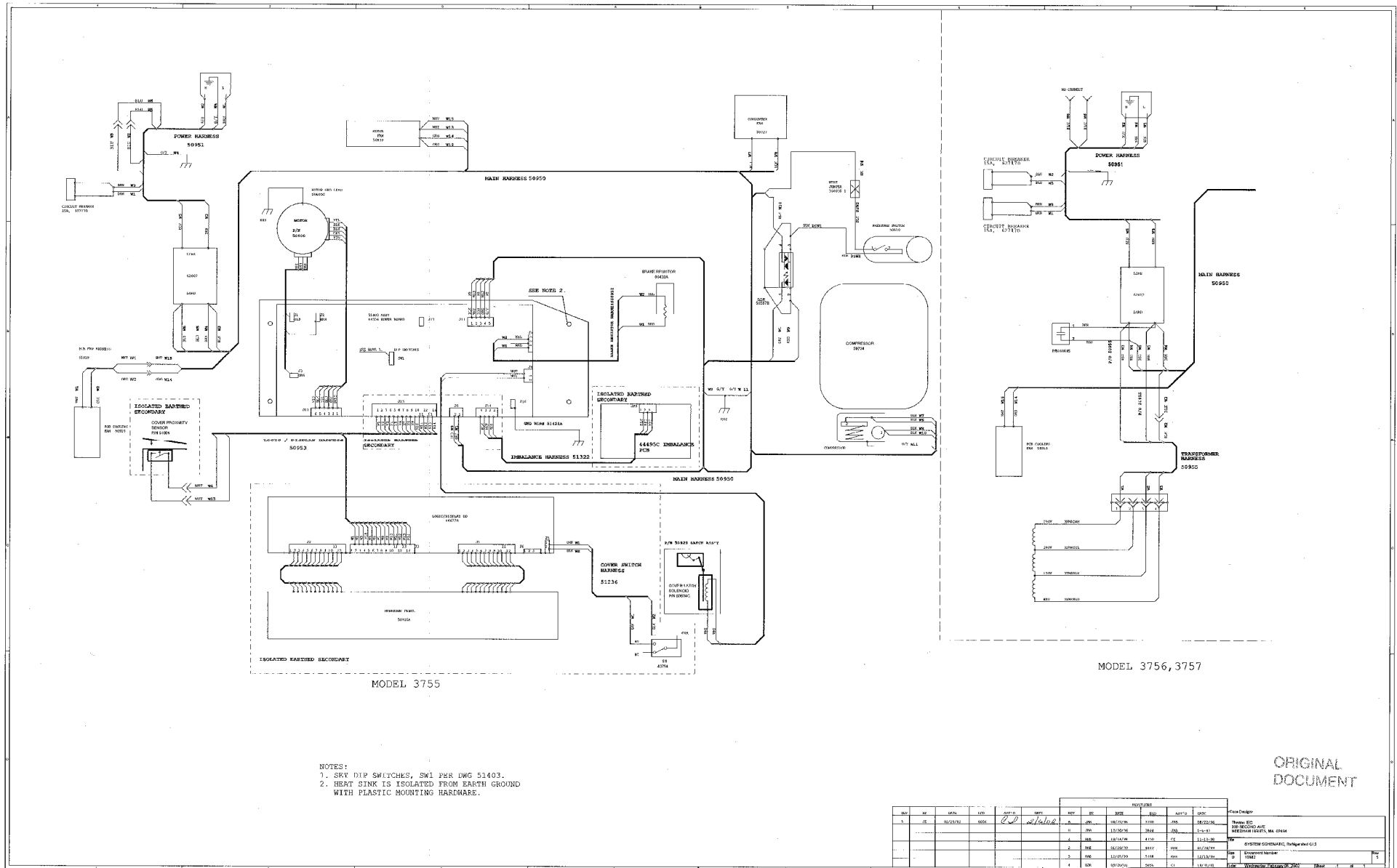
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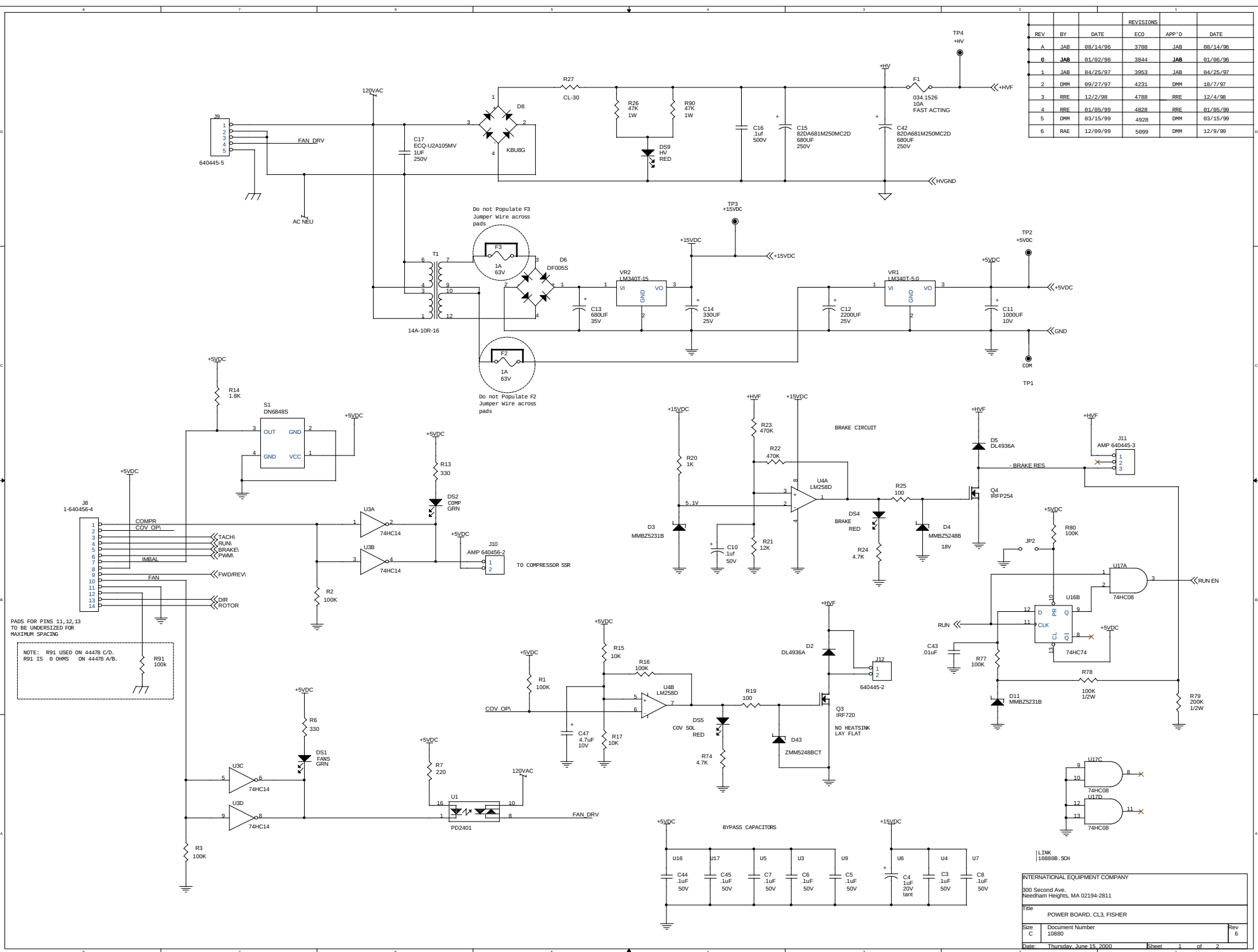
ITEM	QTY	PART NO.	DESCRIPTION	TYPE	REMARKS
1	1	10002	SCHEMATIC DIAGRAM	PART	NOT SHOWN
2	1	33432	TURBINE, SPONAL HUBBER	PART	NOT SHOWN, 4.0 TF AROUND REFUG. TURBINE
3	1	3642	P-GASKET	PART	4.7 C.I.
4	1	44495C	IMBALANCE DETECTION PCB, CL3 & 3200181	PART	6-32 X .375 P.H. PL. 553, 38.00X.16 104 13TH. W/LOW W/
5	4	47249	SUCTION COP. FOOT	PART	2716-1400X 1.00 16.4 LOCITITE 540
6	1	50127	LABEL PROTECTIVE FARTH GROUND SYMBOL	PART	
7	3	50128	LARFI SECONDARY CHASSIS GROUND SYMBOL	PART	
8	1	505970	SOLID STATE RELAY	PART	
9	1	50695C	GROUND WIRE	PART	8-32X.375 WHIZ LOCK
10	1	50124A	COMPRESSOR	PART	NOT SHOWN
11	4	50124B	COMPRESSOR GROMMET	PART	USE ONLY ON 3755
12	4	50124C	COMPRESSOR GROMMET	PART	USE ONLY ON 3755
13	1	50725	CONDENSER	PART	USE ONLY ON 3755
14	1	50726	CONDENSER SHIELD	PART	8-32X.375 WHIZ LOCK
15	1	50727	FAN	PART	817 SELF TAPPING, SEE NOTE 1
16	1	50878A	COMPRESSOR 230/60	PART	810 SELF TAP, 3755, 3757, & 5533 ONLY, BLIND ONLY
17	4	50820B	COMPRESSOR GROMMET	PART	USE ONLY ON 3757
18	4	50820C	GROMMET SLEEVE	PART	USE ONLY ON 3757
19	1	50840A	COMPRESSOR 230/50	PART	USE ONLY ON 3758 & 5533
20	4	50840B	COMPRESSOR GROMMET	PART	USE ONLY ON 3758 & 5533
21	4	50840C	GROMMET SLEEVE	PART	USE ONLY ON 3758 & 5533
22	1	50842	FAN	PART	810 SELF TAP, 3756, 3757, & 5533 ONLY, BLIND ONLY
23	1	505980	MOTOR, BRUSHLESS DC	PART	8-32X.375 WHIZ LOCK
24	1	50597A	MOTOR HOOD	PART	
25	4	50604A	SUPPORT LEGS, CL3/3R	PART	1/4-20X.540 WHIZ LOCK, 10-32X.500 WHIZ LOCK
26	1	50900	SUPPORT PLATE, MOTOR, CL3/3R	PART	1/4-20 WHIZ LOCK
27	4	50911	ISOLATOR	PART	1/4-20 WHIZ LOCK
28	1	50923A	RASE, CL3/3R	PART	3755-57 ONLY
29	1	50923B	RASE, FORMA CL3/3R	PART	5533 ONLY
30	1	50926	HOLE PLUG	PART	3755 ONLY
31	1	50937	BRACKET, FAN	PART	8-32X.375 WHIZ LOCK
32	1	50936	GUARDHOLE ASSY, CL3R	ASSEMBLY	
33	1	50939	FAN, MOTOR	PART	810 SELF TAP, FAN BLOWING IN
34	1	50943	MOTOR SHAFT SEAL RING	PART	1/4-20X.500 PAN HD 375 INGS, SST SCREW
35	1	50950B	MAIN HARNESS CL3R	PART	NOT SHOWN
36	1	50951	POWER HARNESS CL3/3R	PART	NOT SHOWN
37	1	50952	BRAKE RESISTOR HARNESS	PART	NOT SHOWN
38	1	50955	TRANSFORMER HARNESS	PART	NOT SHOWN, 3756, 3757, & 5533 ONLY
39	1	50960	TURBINE, DISCHARGE - CL3	ASSEMBLY	
40	1	50961	TURBINE, SUCTON - CL3	ASSEMBLY	
41	1	50962	TURBINE, PROCESS - CL3	ASSEMBLY	
42	1	50964	DRYER TUBE	PART	RIVET IN PLACE
43	1	51063	POWER ENTRY MODULE	PART	NOT SHOWN
44	1	51322	IMBALANCE PCB HARNESS, 1EC MPER	PART	NOT SHOWN
45	2	51339	URACKET, PCB	ASSEMBLY	1/4-20X.54 WHIZ LOCK, 7N
46	1	51402	SHIELD, PCB	PART	8-32 X .312 PAN HD PHIL. SS
47	1	51403	ELECTRONIC BOARD ASSY'S	ASSEMBLY	SEE DETAIL A
48	1	51404	ADAPTER PLATE, MOTOR	PART	10-32X.215 WHIZ LOCK, 2N
49	4	51419	SHOULDER WASHER	PART	
50	1	51421A	GROUND WIRE HARNESS	PART	NOT SHOWN
51	1	51422	WYCON SHIM, PCB	PART	8-32X.375 WHIZ LOCK
52	1	40430A	MOTOR HOOD RESISTOR	PART	8-32 X .375 PAN HEAD PHIL. SS
53	1	40615	CAPACITOR ASSY, W/LOW VOLT	PART	8-32 X .375 WHIZ LOCK, 3756 & 5533 ONLY
54	1	42607	LINE FILTER - 20 AMPS	PART	8A-32X.375 WHIZ LOCK, 3755 ONLY
55	1	42612	FILTER	PART	8A-32X.375 WHIZ LOCK, 3756, 3757, & 5533 ONLY
56	2	42710	CIRCUIT BREAKER - 15 AMP	PART	1 ON 3755, 2 ON 3756, 3757, & 5533
57	1	45310	FILTER DRYER	PART	
58	1	45692	TEMPERATURE SENSOR	PART	NOT SHOWN, REF. 10187, 35 INTO GUARD BOWL
59	1	COM1	ALL PURPOSE SPRAY LUBRICANT	QUOT. ITEM	E.G. STANLEY 101, NOT SHOWN SEE NOTE 5
60	1	COM1	AMP R360025-1	QUOT. ITEM	NOT SHOWN, PRES. SWITCH TO 50950
61	2	1110114	6-32 X .312 PAN HEAD PHIL. SS	PART	
62	2	1110122	6-32 X .375 PAN HEAD PHIL. SS	PART	
63	2	1120500	10-32X.1/2 SELF TAPPING B	PART	
64	4	1133300	1/4-20 X 1.250 HEX HEAD, CAB	PART	
65	4	1133324	7/16-14 X 1.000 HEX HEAD, SS	PART	
66	4	1183305	1/4-20 X .500 WHIZ LOCK, 7N	PART	
67	4	1183307	10-32 X .300 WHIZ LOCK, 2N	PART	
68	4	1183313	10-32 X .375 WHIZ LOCK, 7N	PART	
69	19	1183316	8-32 X .375 WHIZ LOCK, 7N	PART	
70	4	1240001	SCHULW 1/4-20 X .500 PAN HD SLALING, SS	PART	
71	4	1300100	10-32 HEX LOCK NUT, SS W/INION INSERT	PART	
72	8	1302101	WHIZ LOCK NUT 1/4-20, 2N	PART	
73	4	1401004	750 OD X .210 ID X .125 THK, WYCON WASHER	PART	
74	4	1401111	1/4" FLAT WASHER, SS	PART	
75	2	1401814	.375 OD X .156 ID X .175 THK, WYCON WASHER	PART	
76	4	1401815	1/4" FLAT WASHER, 750 OD X .203 ID X .063 THK	PART	
77	4	1411100	1/4-10 LOCK WASHER SHIELD, SS	PART	
78	4	1424105	1/8" INTERNAL LOCK WASHER, SS	PART	
79	4	1425101	1/8" EXTERNAL LOCK WASHER, SS	PART	
80	1	1889902	SINGLE SIDED VINYL FOAM TAPE, 3/4X1/8	PART	4.7 FT

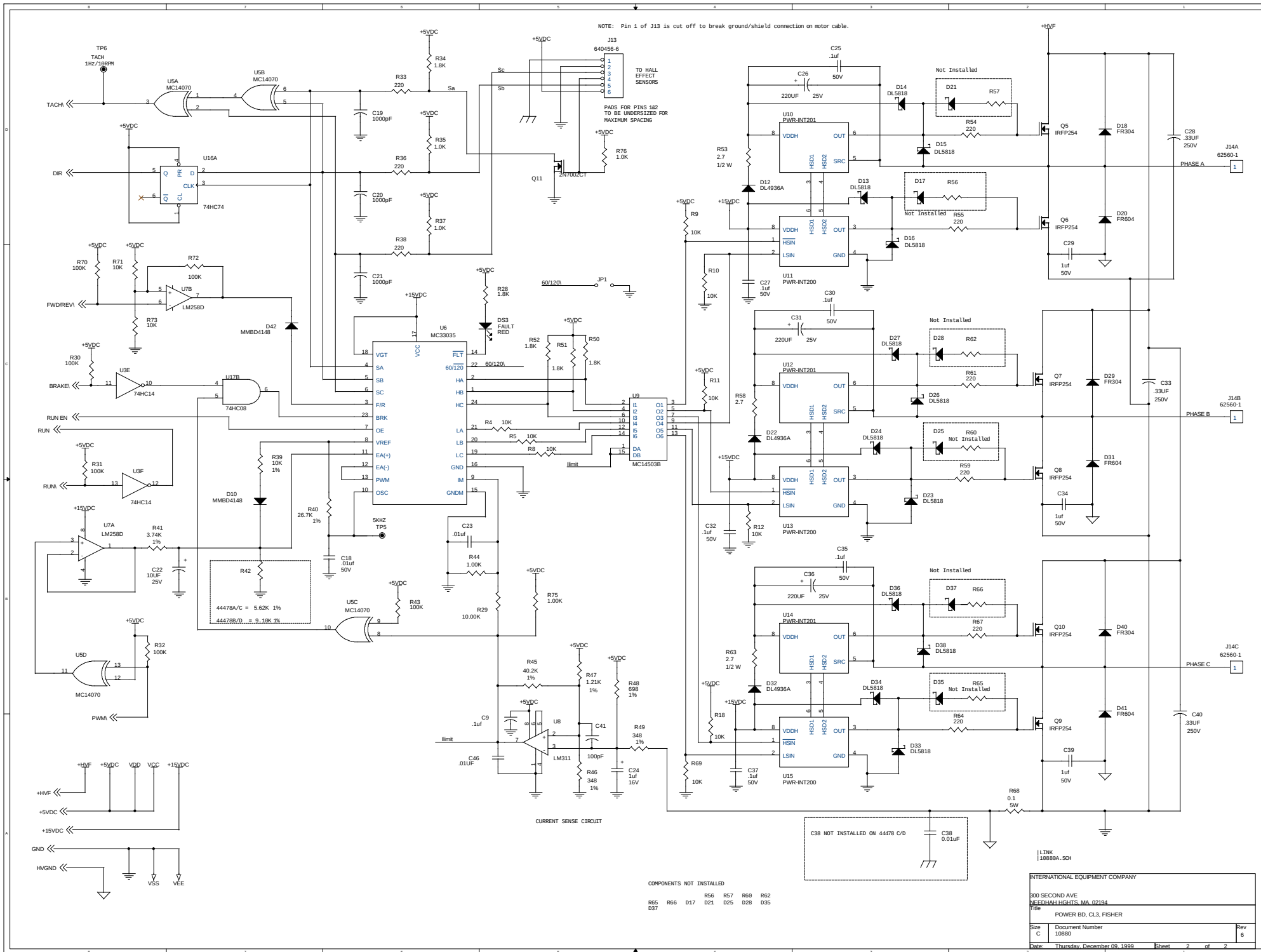


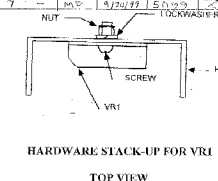
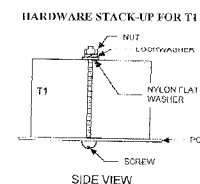




REVISIONS					
REV	BY	DATE	ECO	APP'D	DATE
A	JAB	08/14/96	3788	JAB	08/14/96
0	JAB	01/02/96	3844	JAB	01/05/96
1	JAB	04/25/97	3953	JAB	04/25/97
2	DMH	09/27/97	4231	DMH	10/7/97
3	RRE	12/2/98	4788	RRE	12/4/98
4	RRE	01/05/99	4828	RRE	01/05/99
5	DMH	03/15/99	4928	DMH	03/15/99
6	RAE	12/09/99	5099	DMH	12/9/99







- NOTES:
1. SQUARE PADS INDICATE THE FOLLOWING:
A PIN "1" OF MULTILEAD DEVICES, (DIPS, SPS, POTS, ETC.)
B. PIN ARITY PINS OF DISCRETE COMPONENTS.
(CATHODE, EMITTER, "+", ETC.)
 2. Q4-Q10 MOUNTED ON OPPOSITE SIDE OF P.C. BOARD.
 3. C44 INSTALLED ON SOLDER SIDE. PADS ARE LOCATED OPPOSITE R45.
 4. FOLLOWING COMPONENTS NOT INSTALLED:
C19, C20, C21, B1, B2, B3, D2B, D3B, D3S, B3, B6, R57
R20, R16B, R45, R46B
 5. TO MAKE 44478A, SEE PL-44478A.
TO MAKE 44478B, SEE PL-44478B.
 6. INSTALL C23 IN STANDING POSITION (DO NOT FLAT)
 7. CAT INSTALLED WITH (1) END COMMON WITH R18/17 (2) END
CONNECTED TO CIRCUIT RETURN OR GROUNDING TAB OF D4B.
 8. JUMPER OUT FUSE LOCATION F21FS USING ITEM # 25.

Q4-Q10 TYP.

$\leq \dots .25$ TYP

AS VIEWED FROM COMPONENT SIDE

SCHEMATIC REF. NO. 10880

DATE OF ORDER: _____
DATE OF DELIVERY: _____
INTERNATIONAL EQUIPMENT CO.

ASSEMBLY DRAWING
POWER BOARD CL3/FISHER

44478

SCALE 2/1

Page 1 of 1

CL3/Fisher 1L(R) MOTOR DRIVE BD

ASSY PN 44478B REV 8

ITEM	QTY	REFERENCE	PART/ MANUF.	PKG
1	14	C3,C5,C6,C7,C8,C9 C35,C37,C44,C45 C25,C27,C30,C32,	Capacitor .1UF@50VDC Panasonic ECU-V1H104KBM	SMT 1206
2	1	C16	Capacitor .1UF@400VDC Panasonic ECQ-E4104KF SPRAGUE 5GAP10	Thru-Hole PE.10
3	3	C18,C23,C43	Capacitor .01uF@50VDC NIC NSFC-103J50TRB2	SMT 1206
4	2	C15, C42	Capacitor 680UF@250VDC United Chemi-Con 82DA681M250MC2D	Thru-Hole AMLRP
5	1	C13	Capacitor 680UF@35VDC ILLINOIS CAP 687CKR035M	Thru-Hole
6	1	C14	Capacitor 330UF@25VDC NICHICON UVX1E331MPA	Thru-Hole
7	1	C22	Capacitor 10UF@25VDC Panasonic ECS-H1ED106R	SMT PTEHDD
8	3	C26,C31,C36	Capacitor 220UF@25V NICHICON UVX1E221MPA	Thru-Hole
9	3	C28,C33,C40	Capacitor .33UF@250VDC NICHICON QXJ2E334KTPT NIC NRM334K250	Thru-Hole

CL3/Fisher 1L(R) MOTOR DRIVE BD

ASSY PN 44478B REV 8

ITEM	QTY	REFERENCE	PART/ MANUF.	PKG
10		Not Used		
11	2	DS1,DS2	Diffused Solid State Green PANASONIC LN38GCP	Thru-Hole LED
12	4	DS3,DS4,DS5,DS9	Diffused Solid State PANASONIC LN28RCP	Thru-Hole LED
13	1	D4	Zener 18V, 1/2 Watt Motorola MMBZ5248B	SMT SOT-23
14	2	D3,D11	Zener 5.1V, 1/2 Watt Motorola MMBZ5231B	SMT SOT-23
15	5	D2,D5,D12,D22,D32	Rectifier, Fast Recovery 400V, 1A Motorola DL4936A	SMT DL-41
16	1	D6	Bridge Rectifier 50V, 1A Diodes Inc DF005S	SMT SMBR4
17	1	D8	Bridge Rectifier DIODES INC KBU8G	Thru-Hole BR4\UP
18	2	D10,D42	Diode Motorola MMBD4148	SMT SOT-23
19	12	D13-D16, D23,D24,D26	Rectifier D27,D33,D34,D36,D38	SMT Schottky Barrier DL-41 DL5818
20	3	D18,D29,D40	Rectifier, Fast Recovery 400V, 3A Diodes Inc. FR304	Thru-Hole D027

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CL3/Fisher 1L(R) MOTOR DRIVE BD

ASSY PN 44478B REV 8

ITEM	QTY	REFERENCE	PART/ MANUF.	PKG
22	3	D20,D31,D41	Rectifier, Fast Recovery 400V, 6A Diodes Inc. FR604	Thru-Hole D006
23	2	FH1,FH2	Fuse Holder 5mm X 20mm SCHURTER 0G751.0056	Thru-Hole FH5X20
24				
25	1	J8	Connector AMP, MTA.100 1-640456-4	Thru-Hole HD.100-14U
26	1	J9	Connector AMP, MTA.156 640445-5	Thru-Hole HD.156-5U
27	1	J13	Connector AMP, MTA.100 640456-6	Thru-Hole HD.100-6U
28	1	J12	Connector AMP, MTA.156 640445-2	Thru-Hole HD.156-2U
29	1	J11	Connector AMP, MTA.156 640445-3	Thru-Hole HD.156-3U
30	3	J14C,J14B,J14A	Connector PCB, 250 TAB AMP 62650-1	Thru-Hole HD.250-1U
31	7	Q4,Q5,Q6,Q7,Q8,Q9,Q10	FET 250V, 23 A International Rectifier IRFP254	Thru-Hole TO-AB
32	1	Q3	FET 400V, 3.3 A International Rectifier IRF720	Thru-Hole TO-220AB

CL3/Fisher 1L(R) MOTOR DRIVE BD

ASSY PN 44478B REV 8

ITEM	QTY	REFERENCE	PART/ MANUF.	PKG
33	12	R1,R2,R3, R16, R30,R31,R32,R43, R70,R72,R77,R80	Resistor 100K Ω , 5% Dale CRCW1206104JRT1	SMT 1206
34	2	R6,R13	Resistor 330 Ω , 5% Dale CRCW1206331JRT1	SMT 1206
35	10	R7,R33,R36,R38,R54 R55,R59,R61,R64,R67	Resistor 220 Ω , 5% Dale CRCW1206221JRT1	SMT 1206
36	2	R19,R25	Resistor 100 Ω , 5% Dale CRCW1206101JRT1	SMT 1206
37	6	R20,R35, R37,R44,R75 R76	Resistor 1.00K Ω , 1% Dale CRCW12061001FRT1	SMT 1206
38	1	R24,R74	Resistor 4.7K Ω , 5% Dale CRCW1206472JRT1	SMT 1206
39	6	R14,R28,R34,R50, R51,R52	Resistor 1.8K Ω , 5% Dale CRCW1206182JRT1	SMT 1206
40	15	R4,R5,R8-R12, R15, R17, R18,R29,R39, R69,R71,R73	Resistor 10K Ω , 1% Dale CRCW12061020FRT1	SMT 1206
41	1	R21	Resistor 12K Ω , 5% Dale CRCW1206123JRT1	SMT 1206

CL3/Fisher 1L(R) MOTOR DRIVE BD

ASSY PN 44478B

REV 8

ITEM	QTY	REFERENCE	PART/ MANUF.	PKG
42	1	R22	Resistor 470K Ω , 5% Dale CRCW1206474JRT1	SMT 1206
43	2	R26, R90	Resistor, 1 Watt 47K Ω , 5%	Thru-Hole R1W
44	1	R27	Inrush Current KEYSTONE Limiter CL-30	Thru-Hole
45	1	R40	Resistor 26.7K Ω , 1% Dale CRCW12062672FRT1	SMT 1206
46	1	R41	Resistor 3.74K Ω , 1% Dale CRCW12063741FRT1	SMT 1206
47	1	R48	Resistor 698 Ω , 1% Dale CRCW12066980FRT1	SMT 1206
48	1	R45	Resistor 40.2K Ω , 1% Dale CRCW12064022FRT1	SMT 1206
49	1	R47	Resistor 1.21K Ω , 1% Dale CRCW12061211FRT1	SMT 1206
50	2	R46,R49	Resistor 348 Ω , 1% Dale CRCW12063480FRT1	SMT 1206
51	3	R53,R58,R63	Resistor, 1/2 Watt 2.7 Ω , 5% Phillips 5053CX2R700J	Thru-Hole R1/2W

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CL3/Fisher 1L(R) MOTOR DRIVE BD

ASSY PN 44478B REV 8

ITEM	QTY	REFERENCE	PART/ MANUF.	PKG
53				
54	1	R68	Resistor, 5 Watt .1 Ω , 1% Memcor-Truohm SL5-0.1 DALE LVR-5.0-0.1 Ω	Thru-hole R5W
55	6	TP1,TP2,TP3,TP4,TP5,TP6	Test Point MILLMAX 2108-2-00-44-00-07-0	Thru-Hole
56	1	T1	Transformer Signal 14A-10R-16	Thru-Hole TRAN1-16
57	2	U4,U7	Op-Amp Motorala LM258D	SMT DIP8\SO
58	1	U3	Inverter Schmitt Trigger Motorala MC74HC14D	SMT DIP14\SO
59	1	U6	DC Brushless Motor Controller Motorala MC33035DW	SMT DIP24\SOL
60	1	U5	Exclusive OR Motorala MC14070BD	SMT DIP14\SO
61	1	U9	TRISTATE HEX INVERTER Motorala MC14503D	SMT DIP16\SO
62	3	U10,U12,U14	Mosfet Driver POWER INT PWR-INT201TFI	SMT DIP8\SO
63	3	U11,U13,U15	Mosfet Driver POWER INT PWR-INT200TFI	SMT DIP8\SO

CL3/Fisher 1L(R) MOTOR DRIVE BD

ASSY PN 44478B REV 8

ITEM	QTY	REFERENCE	PART/ MANUF.	PKG
64	1	VR1	Voltage Regulator 5V, 1.5A National LM340T-5.0	Thru-Hole T0-220AB
65	1	VR2	Voltage Regulator 15V, 1.5A National LM340T-15	Thru-Hole T0-220AB
66	1	HS2	HEATSINK For VR2 AAVID 5968B	Thru-Hole
67	1	U8	COMPARATOR MOTOROLA LM311D	SMT DIP8/SO
68	1	U1	SSR CP CLAIRE PD2401 x 7 IR DPA4119 CRYDOM DPA4119	Thru-Hole
69	1	J10	CONNECTOR,2 PIN AMP 640456-2	Thru-Hole
70	1	C17	CAPACITOR,XTYPE 1UF,250VAC PANASONIC ECQ-U2A105MV	Thru-Hole
71	1	F1	FUSE,5X20MM SCHURTER 034.1526	N/A
72	1	PCB	44458(add thru plating to Egnd hole)	
73	1	SCHEMATIC	10880	
74	1	C41	CAPACITOR 100pF,50V PANASONIC ECU-V1H101JCH	SMT 1206
75	1	C11	Capacitor 1000UF@10VDC UCC SME10VB102M10X16LL	Thru-Hole

CL3/Fisher 1L(R) MOTOR DRIVE BD

ASSY PN 44478B REV 8

ITEM	QTY	REFERENCE	PART/ MANUF.	PKG
76	1	Q11	FET small signal ZETEX 2N7002CT	SOT-23
77	1	U16	S-R Latch Motorola MC74HC74D	SOIC
78	1	U17	QUAD AND Motorola MC74HC08D	SOIC
79				
80	1	R79	Resistor,1/2W 200K Ω , 5% Phillips 5053CX2040J	Thru-Hole R1/2W
81	1	C12	Capacitor 2200UF@16VDC Nichicon UVX1C222M12	Thru-Hole
82	1	C24	Capacitor 1uf, 16V Panasonic ECS-H1CY105R	SMT CASE A TANT
83	1	R78	Resistor, 1 /2Watt 100K Ω , 5% Phillips 5053CX1040J	Thru-Hole R1/2W
84	1	S1	Hall Effect Sensor Panasonic DN6848S	SMT
85	1	HS1	HEATSINK For VR1 AAVID 593002B03400	Thru-Hole
86	2	FOR T1 MNTING	SCREW, NYLON PAN HD, 4-40,1.5 LG	
87	3	FOR T1,HS1 MNTING	NUT,SS,4-40	
88	2	FOR T1 MNTING	WASHER,NYLON,	

CL3/Fisher 1L(R) MOTOR DRIVE BD

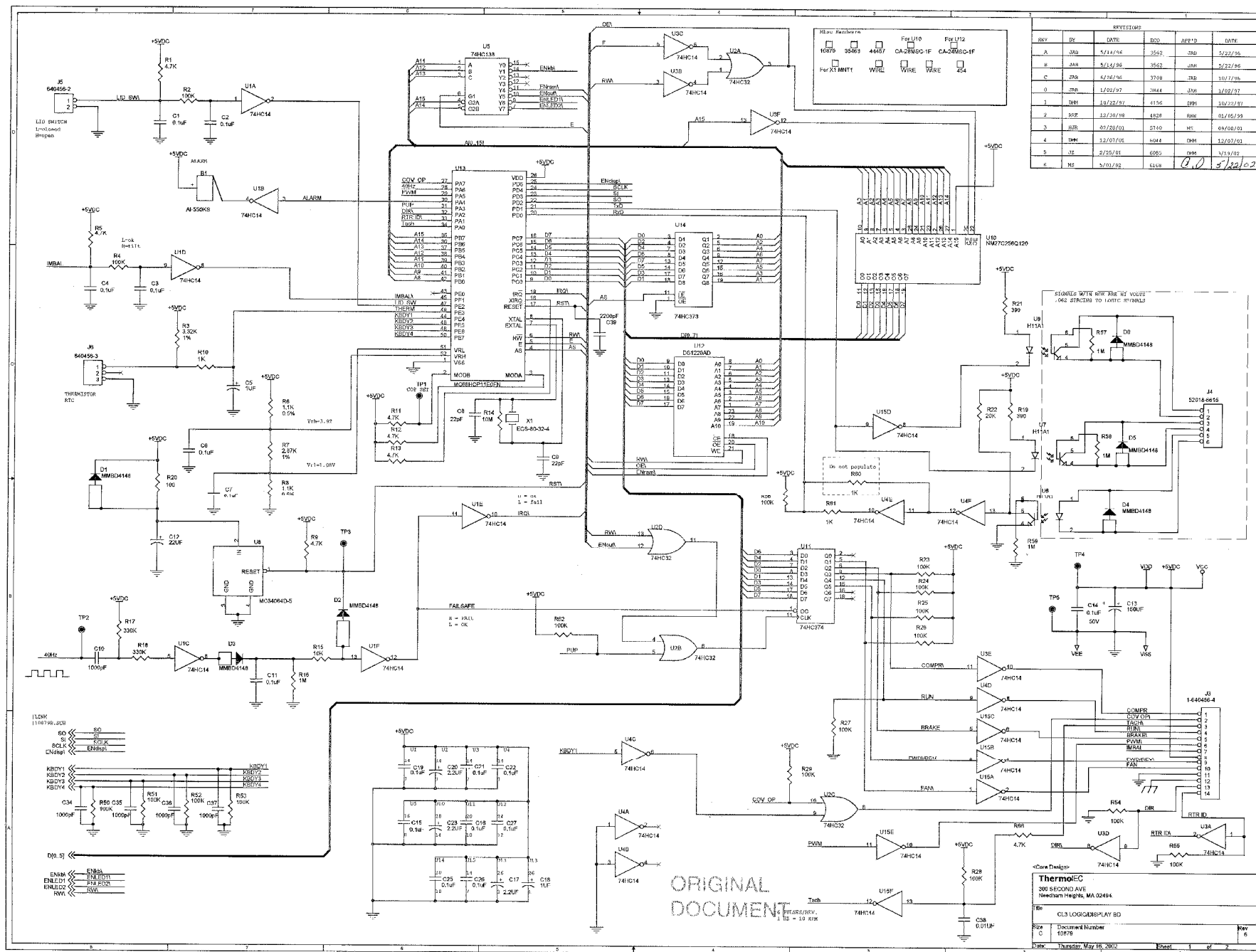
ASSY PN 44478B REV 8

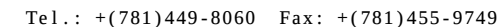
ITEM	QTY	REFERENCE	PART/ MANUF.	PKG
			FLAT, #4	
89	3	FOR T1,HS1 MNTING	WASHER,SS SPLITLOCK, #4	
90	1	FOR HS1 MNTING	SCREW,SS,4-40,.38 LG	
91	1	R42	RESISTOR 9.10K, 1% DALE CRCW12069101FRT1	SMT 1206
92	3	C29,C34,C39	CAPACITOR 1UF,50V NIC NMC1210Z5U105M50	SMT 1210
93	1	C4	CAPACITOR 2.2UF,20V PANASONIC ECS-HIDX225R	SMT CASE B TANT
94		Not Used		
95	2	F2,F3	ZERO OHM JUMPER 20AWG, UNINSOLATED, SOLID	
96	REF	35463	TEST PROCEDURE/FIXTURE	
97	REF	32594	ELECTRONICS PARTS LIST	
98	1	C47	Capacitor 4.7 uF, 10V, Tantalum PANASONIC, ECS-F1AE475K	Thru-hole
99	1	D43	Zener 18V, 1/2W Motorola ZMM5248BCT or Diodes Inc., ZMM5248BT	SMD
100	1	R91	Resistor 100K ohm, 1/8, 5%, MF Generic	Thru-hole
101	3	C19,C20,C21	Capacitor 1000pF, 50V, Ceramic Panasonic, ECU-V1H102JCH	SMD

CL3/Fisher 1L(R) MOTOR DRIVE BD

ASSY PN 44478B REV 8

ITEM	QTY	REFERENCE	PART/ MANUF.	PKG
102	1	R23	Resistor 470K ohm, 1/4, 5%, 250WVDC NIC #NCF25J474TR	Thru-hole
103	1	C10	Capacitor 0.1 uF, 35V, Tantalum PANASONIC, # ECS-H1VY104R	SMD
104	1	C46	Capacitor 0.01 uF, 50V, Ceramic KEMET, C1206C103K5RAC	SMD





Tel.: +(781)449-8060 Fax: +(781)455-9749

Part Number: 44477B
Revision Level: 6

<u>Part Number</u>	<u>Description</u>	<u>Part Reference</u>	<u>Qty</u>
UCN0003-01	Microcontroller Motorola MC68HCP11E0FN	U13	1
TPT0000-00	TEST POINT Mill-max 2108-2-00-44-00-00-07-0	TP1 TP2 TP3 TP4 TP5	5
SPC0006-00	PAD BIVAR CI-192-028	For X1 MNT1	1
SOC0002-00	SOCKET,IC,28 PIN DIP,.6 C-C CIRCUIT ASSY CA-28MSC-1F	For U10	1
SOC0001-00	SOCKET,IC,24 PIN DIP,.6 C-C CIRCUIT ASSY CA-24MSC-1F	For U12	1
RES0171-01	RES, MF, 4.7K, 1/8W, 5%, SM Dale CRCW1206472JRT1	R1 R5 R9 R11 R12 R13 R66	7
RES0162-01	RES, MF, 20K,1/8W, 5%, SM Dale CRCW1206203JRT1	R22	1
RES0161-01	RES 390 Dale CRCW1206391JRT1	R19 R21	2
RES0138-01	RES 680R Dale CRCW1206681JRT1	R39 R40 R41 R42 R43 R44 R45 R46 R47 R48 R49	11
RES0089-01	RES 330K Dale CRCW1206334JRT1	R17 R18	2
RES0082-01	RES 3.32K Dale CRCW12063321FRT1	R3	1
RES0063-01	RES 2.87k Dale CRCW12062871FRT1	R7	1
RES0054-01	RES, MF, 1M,1/8W, 5%, SM Dale CRCW1206105JRT1	R16 R57 R58 R59	4

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RES0050-01	RES, MF, 1K, 1/8W, 1%, SM Dale CRCW12061001FRT1	R10 R30 R31 R32 R61	5
RES0028-01	RES 10M Dale CRCW1206106JRT1	R14	1
RES0022-01	RES, MF, 10K, 1/8W, 5%, SM Dale CRCW1206103JRT1	R15 R33 R34 R35 R36 R37 R38	7
RES0017-01	RES, MF, 100K, 1/8W, 5%, SM Dale CRCW1206104JRT1	R2 R4 R23 R24 R25 R26 R27 R28 R29 R50 R51 R52 R53 R54 R55 R56 R62 R63 R64 R65	20
RES0011-01	RES, MF, 100R, 1/8W, 5%, SM Dale CRCW1206101JRT1	R20	1
RES0005-01	RES 1.1K Dale CRCW12061101FRT1	R6 R8	2
REF35463	TEST PROCEDURE PC BD	REF2	1
REF10879	SCHEMATIC, PC BD	REF1	1
OPT0014-00	IC, OPTO-ISOL GE H11A1	U6 U7 U9	3
LED0027-00	DISPLAY, 7 SEG Lite-On LTS-4301G	DS1 DS2 DS3 DS4 DS5 DS6 DS7 DS8 DS9 DS10 DS11 DS12 DS13 DS14	14
ICD0054-00	EPROM, IEC PN 50513 National NM27C256Q120	U10	1
ICD0050-01	IC, CMOS, QUAD, 2 INPUT OR Motorola MC74HC32D	U2 U22	2
ICD0049-01	IC, CMOS, 3 TO 8 DECODER Motorola MC74HC138D	U5	1

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ICD0048-01	IC,CMOS,HEX D FLIP-FLOP W/Common Clock ----- Motorola MC74HC174D	U19 U20 U21	3
ICD0045-01	IC,CMOS,OCTAL,3-STATE ----- Motorola MC74HC374ADW	U11	1
ICD0015-01	IC,CMOS,HEX,SCHMITT INV, 74HC14, SOIC ----- Motorola MC74HC14D	U1 U3 U4 U15	4
ICD0013-00	IC, RAM, CMOS, NON-VOL, 2KX8 ----- Dallas DS1220AD-200	U12	1
ICD0007-01	IC,CMOS,OCTAL,3-STATE ----- Motorola MC74HC373ADW	U14	1
ICA0010-01	IC,U/V SENSE, 5V, MC34064, SO-8 ----- Motorola MC33064D-5	U8	1
ICA0007-01	DISPLAY DRIVERS ----- Motorola MC14489ADW	U16 U17 U18	3
DIO0005-01	DIODE,SIGNAL ----- Vishay/Lite-On MMBD4148	D1 D2 D3 D4 D5 D6	6
CRY0000-00	CRYSTAL 8.000MHz ----- ECS Int'l Inc. ECS-80-32-4	X1	1
CON0069-00	CONNECTOR, 12 PIN ----- 3M 2412-5212	J1 J2	2
CON0067-00	HEADER, 14 PIN ----- Amp 1-640456-4	J3	1
CON0063-00	CONNECTOR ----- Molex 52018-6615	J4	1
CON0027-00	HEADER, 3 PIN ----- Amp 640456-3	J6	1

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CON0006-00	HEADER,2 Pin	J5	1
	Amp 640456-2		
CAP0209-00	Cap 2200pF, 50V	C39	1
	Kemet C1206C222K5GAC		
CAP0148-00	CAP 2.2UF,10V	C17 C20 C23 C28 C31 C33	6
	Panasonic ECS-T1AY225R		
CAP0146-00	CAP 22UF,10V	C12	1
	Panasonic ECS-T1AC226R		
CAP0145-00	CAP 150UF,10V	C13	1
	AVX TPSD157K010R01M		
CAP0128-00	CAP 1uf,16V	C5 C18	2
	Panasonic ECS-H1CY105R		
CAP0127-00	CAP 0.01uf, 50V, 10%, Z5U, SM	C38	1
	Kemet C1206C103K5UAC		
CAP0110-00	CAP 1000pF,50V	C10 C34 C35 C36 C37	5
	Kemet C1206C102K5GAC		
CAP0106-00	CAP, X7R, 0.1uF, 50V, 10%, SM	C1 C2 C3 C4 C6 C7 C11 C14 C15 C16 C19 C21 C22 C24 C25 C26 C27 C29 C30 C32	20
	Kemet C1206C104K5RAC		
CAP0062-00	CAP MONO CER,22pF,50V	C8 C9	2
	Kemet C1206C220K5GAC		
BPR0000-00	Beeper, Piezo, PC MNT	B1	1
	Piezo Electronics MB02P		
44457	ARTWORK,PC BD	PCB1	1